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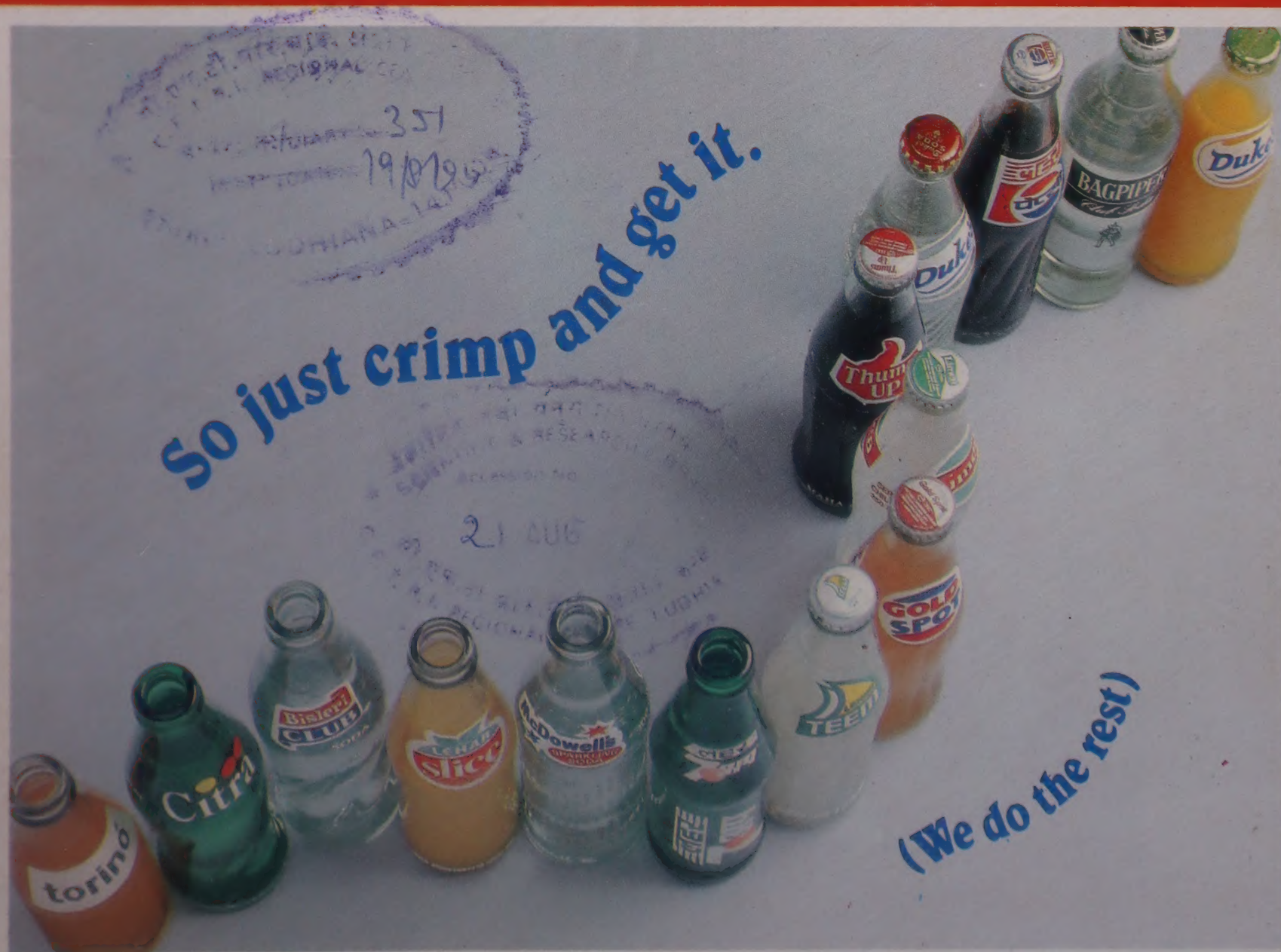


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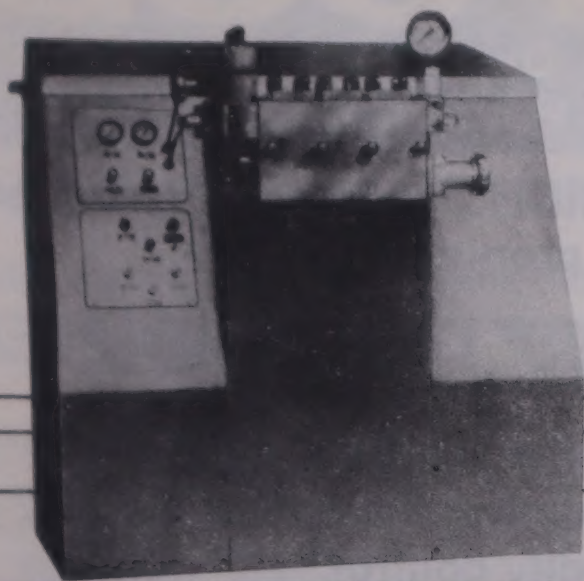
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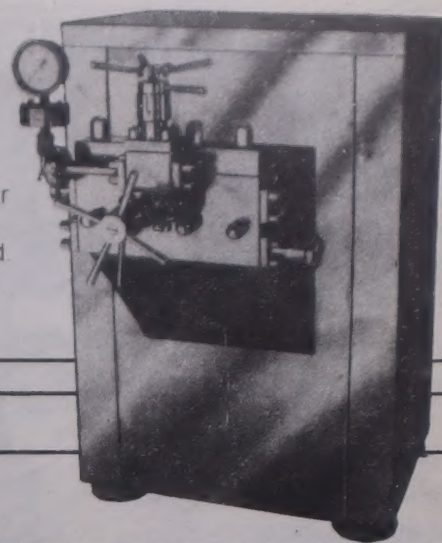
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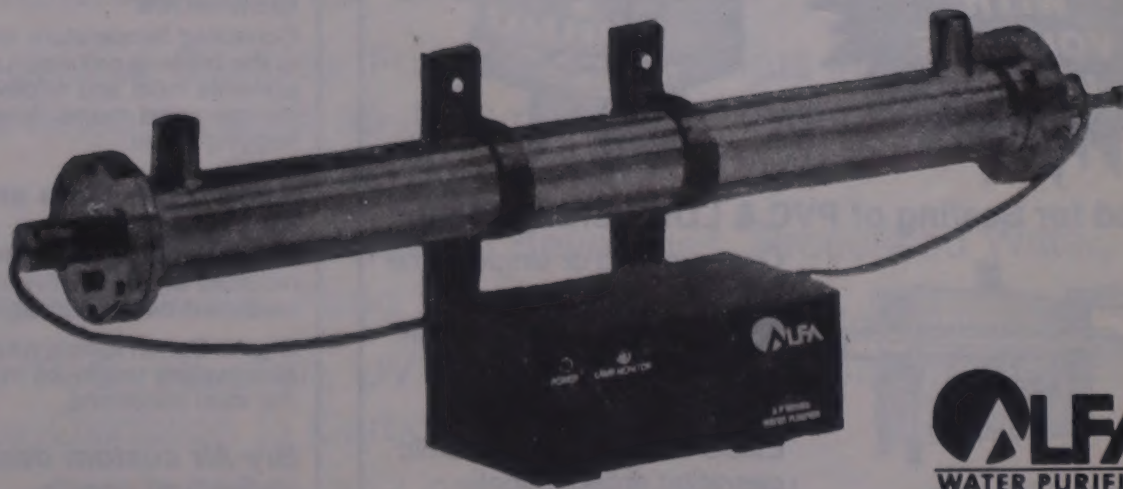
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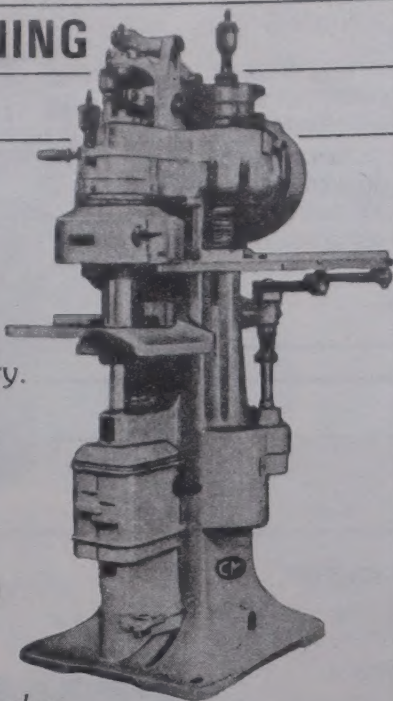
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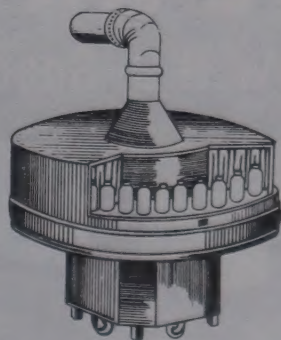
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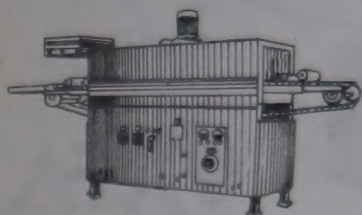
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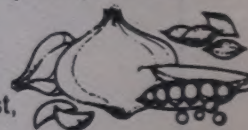
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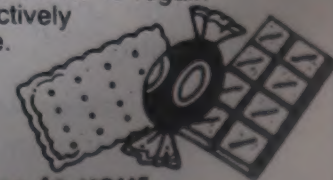
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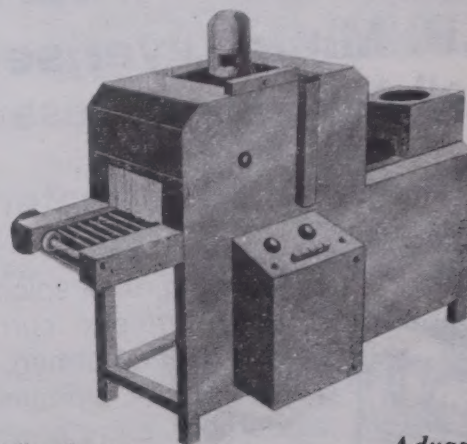
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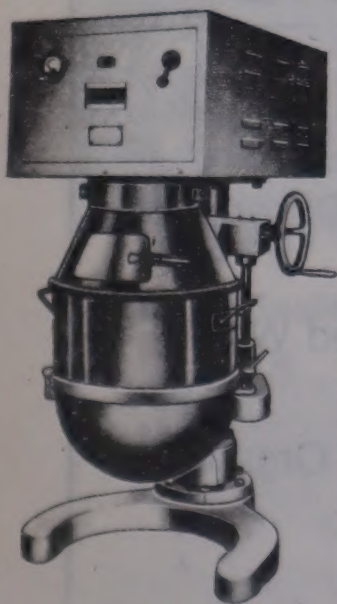
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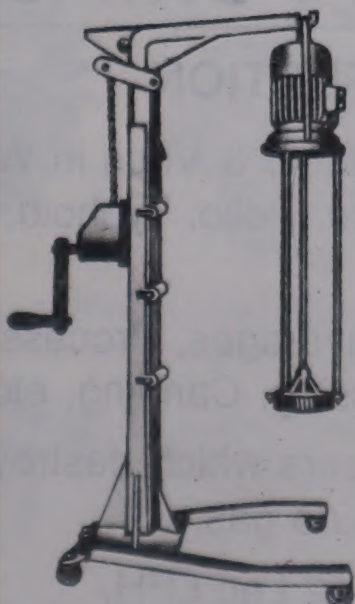
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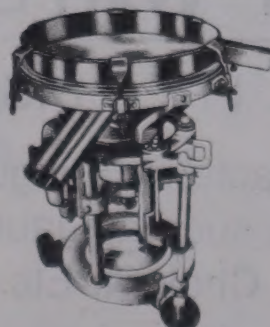
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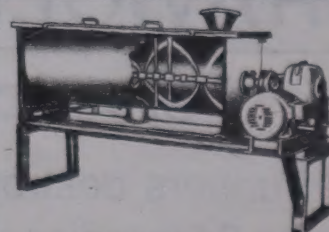
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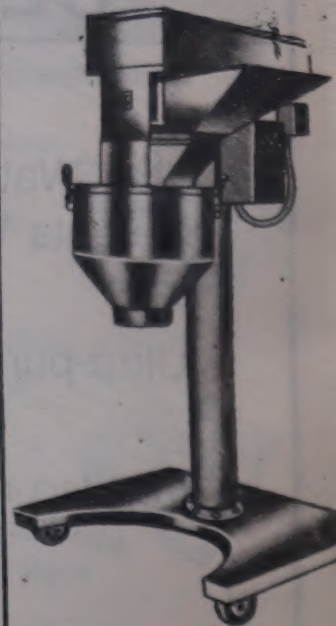
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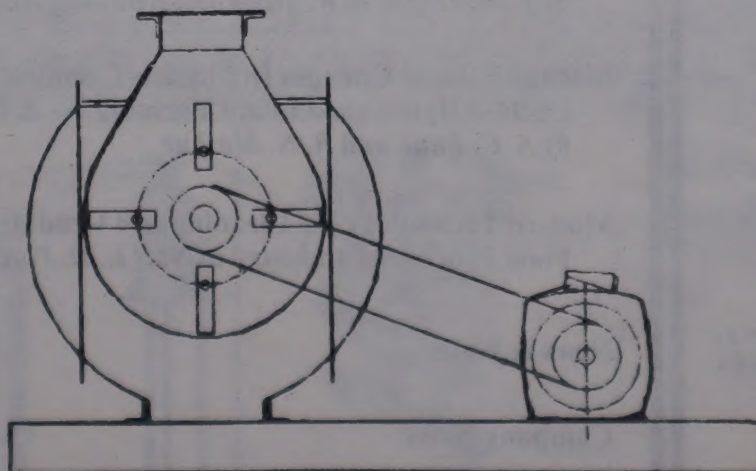
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Osmo-Vacuum Drying of Carrots: Effect of Size of Pieces on Drying Behaviour and Product Quality

by

C. S. Chopra* and N. S. Verma**

* Deptt. of Food Technology, N. D. University of Agri. & Tech., Kumarganj, Faizabad-224 229

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Abstract

The effect of varying sizes of carrot pieces osmosed in cane sugar solution (70°brix) and of their subsequent vacuum drying on the osmo and vacuum drying characteristics and on the product quality were studied. The weight loss, water loss and the nonenzymic browning increased with increase in the size of pieces whereas sucrose gain, rehydration ratio and water content in the rehydrated pieces showed an inverse trend. However, statistically these changes were insignificant. Vacuum drying of large sized pieces required about 33% more drying time than the small or medium ones.

Introduction

Osmotic drying of fruits and vegetables has been the subject of investigation for over thirty years. The potential advantages of this method of drying are less heat damage, less enzymic browning, better retention of flavour and energy savings (Brennan, 1989). According to Rahman and Lamb (1990) the factors which affect the solute and moisture diffusion are the types of osmotic agents, solution concentration, sample solution ratio, osmosis time, osmosis temperature, solution agitation and the geometry of the material. But the information available in literature on the affect of the size of pieces is very scanty and unfortunately no work so far has been reported which deals with the influence of size of pieces on the osmo-vacuum drying behaviour and on the product quality.

In the present investigation, therefore, carrot pieces of varying sizes were subjected to osmo-vacuum drying with the purview to studying their affects on the osmo and vacuum drying characteristics and on the quality of the finished product.

Material and Methods

The crown and the root ends of the freshly harvested carrot roots after thorough washing and manual peeling were trimmed off. The cylindrical shaped pieces of diameter 0.60 cm and of varying lengths (0.60, 0.88 and 1.39 cm) were obtained by using dyes and cork borer. One hundred gram of each lot of pieces were osmosed separately by dipping

Table 1: Osmo-drying characteristics of carrot pieces of varying sizes and the ratio A/L.

Size of Carrot pieces (Dia x Length, Cm)	Weight loss ^x (%)	Water loss ^{x,a} (g)	Sucrose gain ^{x,a} (g)	Ratio ^b A/L
Small (0.60 x 0.60)	40.24 ± 1.87	45.48 ± 1.82	4.83 ± 0.72	791
Medium (0.60 x 0.88)	42.01 ± 1.69	46.45 ± 1.65	4.42 ± 1.02	778
Large (0.60 x 1.39)	43.02 ± 1.51	47.37 ± 1.42	4.31 ± 0.74	743

x Average of values from 3 experiments ± S. D.

a Expressed as g/100 g fresh carrots.

b A/L represents ratio of total surface area of 50 g sample to length of single piece

ping them in 100 ml cane sugar solution (70° brix). The osmosis was carried out at 30 ± 2°C for 8 hrs. Thereafter, the pieces were taken out, were gently washed and blotted. The osmosed pieces were dried in a vacuum oven at 70°C.

Analysis

The separate lots of pieces were subjected to osmosis for the analysis. Excess surface moisture of osmosed pieces were blotted and the samples were weighted immediately. Moisture content in the pieces before and after osmosis and during subsequent drying were estimated by Vacuum drying method as described by Ranganna (1986). Sucrose content in the fresh pieces and in the osmosed pieces were determined by Lane and Eynon's method (1923). To analyze the data, weight loss and water loss due to osmosis were expressed as % reduction in weight of pieces and amount of water removed (g) from 100 g of fresh carrots, respectively. Sucrose gain by the pieces, caused by the diffusion of sucrose during the osmo-process was expressed as the amount of sucrose gained (g)

by 100 g of fresh carrots.

The drying rate was defined as the amount of water (g) removed from 100 g dry matter/min. The dried pieces were also analyzed for the nonenzymic browning, rehydration ratio and the water content in rehydrated product by the methods as described by Ranganna (1986). The data of osmo-drying characteristics and the product characteristics were statistically analyzed by the technique of analysis of variance (ANOVA) as described by Raghuramulu et.al. (1983).

Results and Discussion

The freshly harvested carrot roots utilized in the present study contained 86.93 ± 1.40% moisture and 3.27 ± 0.75% sucrose.

Osmo-drying characteristics

The data presented in Table 1 show that weight loss and moisture loss due to osmosis of carrots enhanced with increase in the size of pieces whereas, sucrose gain exhibited an opposite trend. The maximum weight loss and water loss were 43.02 ± 1.51% and 47.37 ± 1.42 g/100 g fresh carrots, respectively.

Dr. C. S. Chopra

Dr. C. S. Chopra, M. Sc. (Food Technology), Ph. D. (Food Technology) is working as Assistant Professor in the Dept. of Food Technology, N. D. University of Agri. and Tech., Kumarganj, Faizabad (U.P.). He has 10 years of teaching and research experience at Undergraduate / Post graduate level. His research work at Master level involved studies on preparation of a yogurt-like product from soybean. He worked on osmo-vacuum drying of carrots for his Ph. D. degree. He has published many research papers.

Higher weight and water losses as a result of osmosis of large pieces were probably due to lower sucrose uptake (Table 1). The results are in accordance with the mass-diffusion law i.e. solid gain increases with increase in the ratio of A/L (Table 1). Similar results were also reported by Lerici *et.al.* (1985) in the Osmo-drying of apples.

Vacuum drying Characteristics

The data given in Table 2 indicate that for reducing the moisture content of the large sized pieces to the level in the vicinity of the medium and small sized pieces, an additional period of 2 hrs was needed. The drying rates of the small pieces upto 4 hrs vacuum drying were higher than those of medium ones which were followed by the drying rates of the large pieces. The lower drying times of the small pieces might be attributed to the increased rate of water evaporation, caused by the greater surface area of the small pieces. Cruess and Mackinney (1945) also reported that time required for drying of carrots using hot air doubled with increase in the thickness of pieces from 0.323 Cm to 0.625 Cm.

Product Characteristics

Table 3 show that the nonenzymic browning increased with increase in the size of pieces which was probably due to longer thermal exposure of the large pieces as compared to those of the small and medium ones. The rehydration ratio and water content in the rehydrated material decreased with increase in the size of pieces (Table 3) and these differences were probably because of the variations in sucrose uptake, drying rates and the surface areas.

Statistical analysis revealed that the osmosis of different sizes of carrot pieces did not affect the osmo-drying and product characteristics significantly. The large pieces thus can be concluded to be used in the osmo-vacuum drying of carrots as more energy would be required to obtain the small pieces than to obtain the large ones. However, addi-

Table 2 : Vacuum drying characteristics of osmosed carrot pieces of varying sizes

Size of Carrot pieces	Moisture content (% db) at different intervals of time (min) during vacuum drying				
	0	120	240	360	480
Small	250.02	67.59 (1.52)	18.22 (0.41)	4.83 (0.11)	-
Medium	253.98	73.91 (1.50)	27.76 (0.38)	4.91 (0.19)	-
Large	246.50	74.85 (1.43)	31.63 (0.36)	13.02 (0.16)	5.27 (0.06)

Average of values from duplicate experiments.

Figures in parenthesis indicate the drying rates (g of water removed/100 g dry matter/min).

Table 3 : Product characteristics of osmo-vacuum dried carrot pieces of various sizes

Size of carrot pieces	Small	Medium	Large
Nonenzymic browning (OD at 420 nm)	0.1911 \pm 0.0140	0.1953 \pm 0.0225	0.2049 \pm 0.0145
Rehydration ratio	3.58 \pm 0.13	3.40 \pm 0.23	3.14 \pm 0.18
Water content (% wb) in rehydrated carrot pieces	73.26 \pm 0.99	71.75 \pm 1.92	69.54 \pm 1.75

Average of values from 3 experiments + S. D.

tional studies would also be needed to be conducted for comparing the requirement of energy for dicing to that required for vacuum drying process, since large pieces also required 33% more drying time in the vacuum drying process.

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Micro-organisms as Indices Of Food Quality

by

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Quality, defined as the degree of excellence is the composite of characteristics that has significance from a practical stand point, even beyond one's nutritional needs. Indicator organisms have been used to determine an objectionable microbial condition of food such as faecal contamination, the presence of potential pathogens causing food spoilage and sanitary conditions of food processing, production or storage.

There are certain criteria which determine the value of an indicator organism :

1) The indicator should not be present as a natural contaminant of the material being analyzed.

2) The organism should be easy to grow and differentiate.

3) The indicator organism should withstand the processing treatment of the food in a manner similar to the pathogens.

Indicator organism mainly include the enteric bacteria, viruses and protozoa. Viruses and protozoans are more difficult to enumerate than bacteria. Bacteria belonging to the family of coliforms, enterobacteriaceae, enterococci, pseudomonas, clostridia, staphylococci have been suggested as indicator organisms. Indicator organisms are used to avoid the laborious process and expensive equipments needed to identify and isolate pathogens from food. In general we can say that indicator organisms play a significant role in assessing the microbiological safety and quality of food.

Indices of Different Food Classes :

1) **Water** : *E.coli* is used as a microbial index. Presence of *E.coli* indicates contamination from sewage and the presence of salmonella and other intestinal pathogens. However sampling programmes for drinking water system need larger sample volume to generate better information on water samples (1).

2) **Blanched Vegetables** : Coliforms are the common contaminants of this class (2,3). Good quality vegetables should contain less than 500 *E.coli* per 100 grams. In case of acid food like tomato products, presence of spore forming rods is indicative of underprocessing. This may be due to either flat sour bacteria of butyric anaerobes. which break down of its

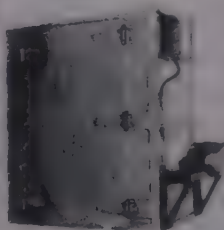
growth breaks down the tissues of fruits and vegetables to form rot. Hence its presence is a reliable index of rotten raw quality material used in the manufacture. High yeast spore count and mold count especially of *Oospora* spp. indicates the unsanitary conditions prevailing in the plant premises. Selected metabolites of *Erwinia carotovora* are used as indicators of quality for peas, carrots and tomatoes (4).

3) **Meat and Poultry products** : Coliforms like *E. coli*, *Salmonella S. aureus*, *C. perfringens*, mesophilic clostridia, yeasts, molds, lactics, *Pseudomonas*, enterococci have been used as indicator organisms to assess microbial safety, sanitation conditions during processing and keeping quality of product (5). Meat and poultry products being perishable foods act as good source of micro-

bial infections and have been implicated in major food borne illnesses as illustrated in Table -1. Aerobic plate count, coliforms and *E. coli* are the most commonly used indicators of sanitary quality of meat and poultry products (5). Cooked products (6) which receive significant handling in ambient temperature rooms (> 20°C) before packaging are more likely to become contaminated with a variety of bacteria, including enteric indicators. Usually this contamination involves microbial growth on equipment, which had been inadequately cleaned. The presence of *S. aureus* in meat and poultry products may indicate contamination from the mouth, nose, skin and other sources. The type of contamination may come from workers handling the food and also from contact with inadequately cleaned equipment or raw animal products as

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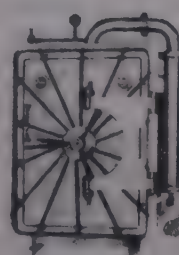
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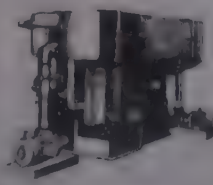
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Table 1.

Examples of products which have been implicated in food borne illness and their etiological agent.

Product	Etiological agent
Roast beef	Salmonella
Barbecued chicken	Salmonella
Dry sausage	<i>S. aureus</i>
Ham	<i>S. aureus</i>
Raw cooked beef	Salmonella
Cooked beef / turkey	<i>Cl. perfringens</i>

these organisms are commonly found on hides, feathers and skin. High count of enterobacteriaceae has also been reported as an indicator of unhygienic and for post processing contamination (7). Gram negative rods such as *Pseudomonads* and total count at 20°C for 3 days has been used as indicators of spoilages of fresh meats and poultry. The incidences of salmonellae in raw meat has been documented (8, 9, 10). Risks exist if these products are improperly cooked. Thus these can be used as indicators of improper processing of poultry products.

4) Dairy products : These can be divided into five categories : (1) fluid milk, either raw or pasteurised (2) concentrated or dry milk products encompassing evaporated milk, condensed or sweetened condensed milk, and dry dairy products (3) butter (4) cheese, natural and processed, and other fermented products; and (5) ice cream and related frozen products.

5) Fluid milk, raw and pasteurised : Milk is a biological product produced by and taken from animals. Even when milk is aseptically removed from the udder, bacteria are present. Counts from under udder may vary from 100 - 10,000/ml, but the average number of bacteria usually present is probably 500 - 1000/ml. Fortunately, from the view point of the sanitarian and processor, the organisms present are limited to only a few genera, primarily micrococci, streptococci and some diptheroid like rods. Pathogenic bacteria also may be found in milk of clinically effected cows. High SPC of somatic cells indicate abnormal conditions. The presence of coliforms in appreciable numbers is attributed to inefficient cleaning and sanitising of dairy equipment and the persistent secretion of large number of coliforms by individual cows, however, may be indicative of coliform mastitis. Thermophilic bacteria are not known to be present in aseptically drawn milk. Therefore, their presence in relatively large numbers in either raw or pasteurised milk indicates consistent failure to clean and sanitise milk contact surface at the farm or the plant. Psychrotrophic organisms also do not originate in milk as taken from the udder. Their number in raw milk may be directly

related to lack of proper sanitation and the time and storage before processing. With the exception of a few gram positive, spore forming rods, most psychrotrophs do not survive proper pasteurisation. Their presence in pasteurised dairy products again indicates the survival of few active cells combined with the length of storage, or the distinct possibility of improper handling, packaging and sanitising techniques. From the standpoint of quality assurance potential for product spoilage and ubiquity, the psychrotrophic bacteria are undoubtedly the most important organisms known to the dairy industry today (11). Psychrotrophic bacterial count has also been reported to be the most reliable method of indicating conditions of production on farm (12). The use of enterococci as sanitary indicators in water and other foods has suggested that they might also be good indicators of raw and pasteurised milk (13).

6) Concentrated and dry milk products: Overall the microbiological evaluation of concentrated or dried dairy products is simple and involves little else than plating of total numbers, coliforms, yeasts and molds and in some instances depending upon ultimate use, fecal streptococci and thermophiles. High SPC in skimmed milk powder can be considered as the contamination occurring grinding and filling of the powder. High yeast and mold count indicates unsanitary conditions of handling and contamination from air. High *Staphylococci* count indicates contamination from nose and hands of employees. Spore count above 150/g indicates that they might have survived the high heat treatment.

7) Butter : Psychrotrophic bacteria, being mostly proteolytic and lipolytic, are frequently associated with the deterioration of butter. They are, however, along with coliforms, yeasts and molds, predominantly heat labile and should only be present because of post pasteurisation contamination. However, with the introduction of frozen storage, the levels of these organisms in butter has decreased. Enterococci on the other hand, are more salt tolerant and survive at low temperature. Present bacteriological testing procedures appear to be adequate for their intended purposes.

8) Cheese and other fermented dairy products : Cheese is the most complex dairy product. Cheeses may be natural or processed. The bacteriological complications ensuing from their processing techniques are frequently not understood or appreciated by many buyers and even by some health officials. A school of thought believes "total counts" to be essentially meaningless in evaluating good manufacturing practices (GMP's), and microbial criteria for finished cheeses are not nearly as valuable as proper control of

fermentation and acid development during cheese making. Thus routine microbial tests for specific organisms which are exercised post manufactured have not been showed to be sound indicators of cheese quality of safety. The same comment can be validated to the other dairy products. However, presence of *Clostridium tyrobutyricum* spores in cheese (>1 spore/ml), indicates that milk used for cheese making was not of appropriate quality. It is considered that the presence of a large proportion of thermophilic streptococci in fresh cheese is indicative of contamination during manufacture. Presence of coliforms in processed cheese (14), indicated either too low a melting temperature was employed or unhygienic conditions prevailing in the plant. In case of cultured dairy products like yoghurts, detection of *Candida lusitanae*, *Candida krusei*, *Candida rufosa*, *Kluyveromyces fragilis*, and *Saccharomyces cerevisiae* are indicative of the fact that yoghurts are marketed under improper refrigerated conditions.

9) Icecream and related products : The methods and tests carried out to determine the sanitary quality of icecream and related product are similar to those carried out for pasteurised milk. Standard plate count, coliform, yeast and mold, psychrotrophic and spore count are applied as indicator of overall icecream processing. A detailed review of assessment of the product quality and its potential shelf life is reviewed by Bishop et.al. (15).

10) Fish and Shell Fish : With rapid industrialisation, water used for human consumption or harvesting of shell fish or fish have become hazardous. Faecal contamination has also lead to many cases of food poisoning because of sea food consumption. For an indicator organism to be useful, there should be a direct relationship to the degree of faecal pollution and the indicator organism should always be present in water where pathogenic bacterial constituents of faecal contamination are present. A number of bacteria such as coliforms, faecal coliforms, *E. coli*, faecal streptococci, *Cl. botulinum*, *Cl. perfringens*, and other clostridia have been used as indicators of faecal contamination (16, 17). Most of the literature data indicate the acceptance of faecal coliform and *E. coli*. However, other organisms like *S. pyogenes* and *S. aureus* may be considered as possible handling contaminants with of without sanitary significance. Shell fish are known to be potential carriers of pathogenic bacteria and viruses (18). In case of oysters, an aerobic plate at 35°C of 500,000/g with the faecal coliform level of 230/100g is the maximum acceptable level of bacteria. In case of frozen foods, enterococci may survive longer than *E. coli*, and hence it is a better indicator of

choice. In case of depurated shell fish, *Cl. perfringens* is usually removed during depuration (18). Its presence after this process would indicate contamination and unfit for human consumption. In case of clams, *S. aureus* and enterococci counts are used as indices of sanitary condition. Enterococci have been suggested by Indian specifications as indices of faecal contamination, allowing a maximum of 100/g. In case of Kamaboka, a Japanese fish, *E.coli* and enterococci are used as indicators of faecal oral cycle and parameters by various processing steps like filleting, thawing, mixing, grinding etc (19). Besides serving as indicators of food quality, microbes as indicators of deficient processing are also reported. This is particularly so with respect to a group of indicator organisms called 'Lancefield Group D Streptococci' which have been used to indicate deficient processing in case of dried milk and egg products, vacuum packed sliced meat products and treated waters (20). These streptococci show a considerable resistance to heat treatments, low temperature, freezing, exposure to a low water activity and disinfectants although sufficient data are lacking, these have been used as index organisms for hepatitis A virus.

A very intriguing question arises as to why do we associate only certain microorganism with particular food product. Does that mean to say that the particular food product has the constituents which are favourable for the growth of that particular organism and are in some way detrimental to the other? It is a very difficult question to answer, in the sense, that it is observed that sometimes more than one microorganism is associated as an indicator of food quality. In some food products like water, *E.coli* is supposed to be an indicator organism because it is associated with sanitary condition since it is found on human body. Thermotolerant bacteria have been associated with the milk quality because presence of these organisms indicate that pasteurisation is not optimally carried out. Presence of *Cl. botulinum* in refrigerated food is indicative of the fact that refrigeration is not properly carried out as these organisms can survive very low temperature. But in true sense we would infer that *E. coli* is the organism, which can be classified as index organism, the others have been mostly detected for their pathogenicity.

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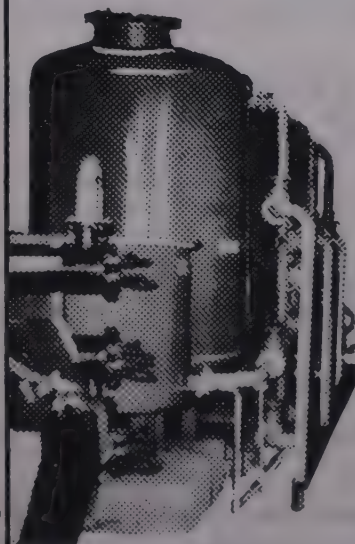
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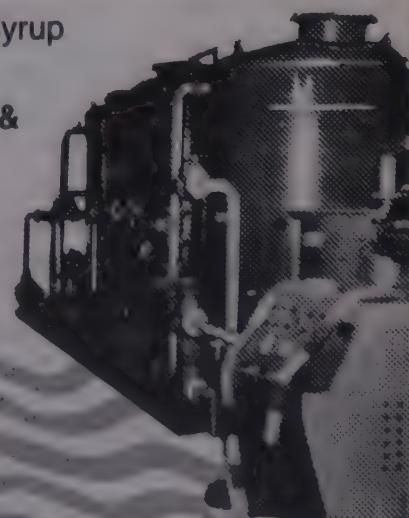
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Use Of Ultrafiltration In Cheese Industry

by

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The Latin word, 'membrane' describes 'a skin of parchment'. In today's more general usage the word 'membrane' has been extended to described a thin sheet of film. However, membrane materials possess a more critical property. They are semipermeable that is they act as porous barriers and allow the selective passage (separation) of materials, particles or molecules, of one kind to pass but exclude others.

Technological advances, energy considerations and economic pressures have led the food industry to introduce many new processing techniques in the recent past. In this series of processing techniques, membrane technology evolved in late sixties, is now considered as an extremely useful technique for removal of water and fractionation of components from fluid food mixtures.

Membrane technology is also not away from dairy industry as it is suggested that **Ultrafiltration** cheese making would largely replace traditional manufacturing method, however at present the procedures are being used commercially for only a limited number of cheese type.

Membrane Process

Membrane separation processes are based on osmosis which is the ability of semipermeable membrane to discriminate between molecules on the basis of molecular size shape and to a lesser extent chemical composition. The process has been commercially viable by development of membranes with reasonably high flux (dewatering rates) and ability to withstand high pressures.

Commonly used processes are reverse osmosis (RO) and ultrafiltration (UF). For both RO and UF, feed solution is pumped under pressure over the surface of the membrane. RO, the membrane rejects all components of a solution except water. Consequently, osmotic operating pressures of 34 to 102 kg/cm are common in effect, RO is essentially dewatering technique.

Beside being dewatering technique, UF also is a fractionation purification and macromolecules concentration method. The membrane retains materials with large molecular weights, while solutes with low molecular weights are passed through. Pressure for UF

are lower than for RO. Permeability and selectivity characteristics of membranes can be controlled during its manufacture by varying the pore size or "molecular weight cut-offs".

Ultrafiltration in cheese making

In cheese making UF technique is employed as this membrane retains materials with large molecular weight while solutes with low molecular weights are passed through. Pressure for UF are lower than RO. By careful selection of membrane characteristics and operating parameters, one can selectively remove the undesirable components. Since no heat or chemical treatment is required, the product obtained is of improved functional properties. In addition, proteins lost in conventional processes are retained.

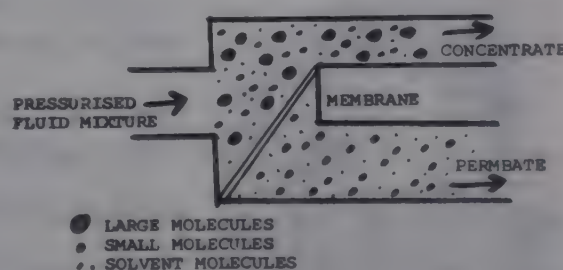
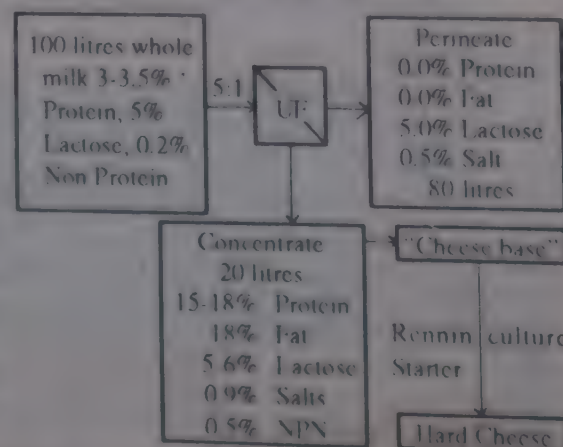


Fig. 1 : Principle of Ultrafiltration

The Australian Developed UF - Hard Cheese Process

The diagram below indicates an ultrafiltration process to produce a high-protein "Cheese base" from whole milk:

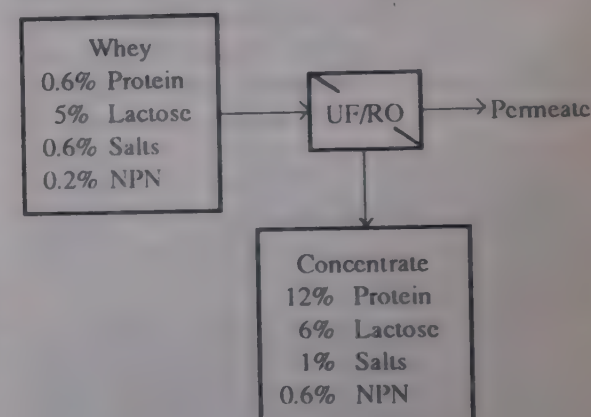
Whey obtained from above process may be passed through a 2000 molecular weight rejection membrane or a reverse osmosis to produce milk protein concentrate or Whey



Protein concentrate.

1. Concentration of milk by UF For Cheese Making

Significant progress has been made in the design of UF systems in the last 15 years. Problem in UF cheese making now reside



with the new technology required to convert the retentate into cheese with the desired characteristics rather than with the production of the retentate itself.

The role of the UF plant in cheese-making is to produce a retentate with total solids at a suitable level. In addition the milk components must be present in the correct proportions, the physical state of the components must not have been adversely affected and the concentrate must be of high microbial quality.

Control of Retentate Composition

The solid content of retentate should be checked as with the fixed retentate composition it is possible to make a cheese of relatively uniform quality and to improve the control of cheese weights.

The content of Ca^{++} and other minerals in the retentate may be regulated by altering the pH of the milk or adding NaCl, either before or during ultrafiltration or diafiltration. This is necessary to obtain a suitable Calcium to protein ratio or Calcium to solids non fat (S. N. F.) ratio in the cheese. The concentration of lactose in theretentate can be reduced by diafiltration.

Effect if UF on milk components

During UF a viscous retentate is pumped

at temperatures which are usually between 50-55°C and this may cause changes to the milk components.

A. A reduction in fat globule size occurs early in the concentration process and damage to fat globule membrane take place.

B. Whey proteins may be denatured at the air/water interface if bubbles of air become incorporated into the retentate.

C. UF at 60°C for 4-5 hr. gave minimal denaturations of the whey protein.

D. Even with a temperature of 54°C and time of 2 hr. some whey proteins become associated with casein.

Technical problem arising during the conversion of concentrated milk into cheese

The conversion of retentate into cheese presents new manufacturing problems and major technological difficulties are known to exist when making some type of UF cheese.

A. **Viscosity of retentate** : The viscosity of retentate increases markedly when the protein content exceeds 14%. Hence milk concentrated five fold or more is comparatively viscous. It is, therefore, difficult to mix rennet and starter uniformly with such milk and consequently coagulation and starter growth may not be proper. As a result the pH throughout the retentate may vary and problems with cheese texture may occur. In addition, because retentates have a high viscosity they do not cool quickly and rapid growth of microbial contaminants can therefore occur. Another problem associated with high viscosity is that any air bubbles in the retentate are not released quickly and become incorporated into the product, giving a spongy texture.

B. **Starter Activity** : A basic difference between traditional and UF cheese making is the higher buffering capacity/unit volume of retentate. Relatively large amounts of lactic acid must be produced to give the required pH changes in the concentrated milk. The ability of lactic cultures to develop acid in retentates varies considerably and only highly active starters must be used. Failure to reduce the pH increases the risk of growth of undesirable bacteria. Some starters grow larger number in retentates, resulting in high concentration of bacterial enzymes and a greater degree of proteolysis in certain types of UF Cheese.

C. **Coagulation of concentrated milks** : Gel formation usually occurs in UF concentrates when only a relatively small fraction of the micellar K-casein has been hydrolysed as the concentration of milk increases this fraction decreases. Micelles that are not sufficiently modified at the point of coagulation are gradually hydrolysed as cheese making proceeds and become incorporated into the

coagulum network structure.

Gel prepared from retentates become progressively coarser as the conc. factor of the milk increases. When these gels are converted into UF Cheddar cheese the coarse protein network is maintained, as the curd becomes coarser. However, the use of homogenised concentrates results in a coagulum with a less coarse protein network which retains more moisture and fat and gives cheddar cheese with less extensive textural abnormalities than non-homogenized concentrates.

Electron microscopic studies indicate that UF curd has a coarser protein network and differs in basic structure from a conventional curd. There is less whey to cushion in UF curd. Thus there is physical damage and prevents the material from aggregating.

Differences between the composition of UF and conventional cheese calcium and whey proteins

The most significant difference is the greater proportion of whey protein in UF cheeses and this has important implications as far as product quality is concerned.

A. **Calcium to protein ratio in UF cheese**: The calcium/protein ratio required in UF cheese is uncertain but would be expected to depend on product variety. Further research is needed to define the role of the Calcium/protein ratio in UF cheese.

B. **Extra protein content of UF cheese**: Both the total quantity and the composition of whey protein in the milk, and therefore in UF cheese, vary with factors such as the stage of lactation and the state of the health of the cows. This variation means that quality of UF cheese and yield improvement may not be constant. On average the major whey proteins β -lg and α -la constitute about 60% of the extra nitrogenous material retained in UF cheese. The remainder consists largely of bovine serum albumin, immunoglobulins and the ill-defined fraction called **proteoseptone**, the other protein component present in UF cheese, that is normally lost into the whey, to the macropeptide fraction of K-casein.

C. **Influence of Whey Proteins on the Properties of cheese** : The proportion of whey protein in traditional cheese is very small e.g. cheddar contains about 0.3% whey protein. These proteins are therefore considered to have a minor influence on the characteristics of conventional varieties. The effect of whey proteins on the properties of UF cheese is still a matter of debate.

D. **Undenatured Whey Proteins in UF Cheese** : Undenatured whey protein appear to be resistant to rennet starter bacteria and plasmin. It is said that undenatured whey proteins act as an inert filler resulting in a

cheese with a smoother texture. This texture change has been attributed to the fact that the whey proteins do not participate in the formation of the casein matrix in cheese and may even disturb this matrix. Since the strength and firmness of a traditional cheese is due, to a large extent, to the casein framework, the inclusion of upto 20% undenatured whey protein would be expected to affect the texture, particularly in cheese with relatively low moisture content.

In some cases the whey protein fraction may directly influence biochemical changes occurring during cheese ripening e.g. the presence of proteinase and peptidase inhibitors in this fraction has been reported to result in lower concentrations of free amino acids in some UF cheeses than in traditional varieties. There is also evidence from gel-electrophoresis measurements suggesting that the residual rennet in UF cheddar is inhibited by the whey proteins fraction.

It is also possible that the whey proteins influence cheese ripening indirectly. Their presence in UF cheese could have a dilution effect by lowering the proportion of casein in the product. Casein is the origin of many of the flavour compounds in many cheeses.

Measures have been suggested to counteract the influence of undenatured whey proteins and increase the rate of maturation of UF cheeses. The flavor of UF cheddar was reported to be improved by adding a proteolytic strain of *Lactobacillus helveticus* with the normal starter. The lactobacillus, although partly inhibited, was sufficiently active to increase the level of free amino acids in the UF cheese to that found in the conventional cheddar. The addition of neutral proteinases to improve the flavour of UF cheese is another possibility suggested. Increasing the residual rennet to a level above that found in the traditional cheese can also increase proteolysis rates without causing bitterness in UF cheddar.

E. **Heat Denatured Whey Proteins In UF Cheese** : Denaturation of whey proteins is an essential step in the manufacture of certain UF cheeses. To obtain a smooth texture with UF cast Feta, suitable heat treatment of the milk before ultrafiltration is required. Heat treatment after UF may also be given to destroy any bacteria which may have been concentrated in the retentate. Heat treatment of the retentate alone is considered to be less effective. The smoothness of the product depends on the heat treatments used. When milk is heated, the physical state of minerals component is altered. Whey proteins are denatured and complex with the casein micelles (β -lg may react with K-casein). This is possible that such complex reduce casein interactions, thereby altering the basic framework of the cheese and giving

a smooth texture. When β -lg is denatured, not only are the sulphhydryl groups exposed but so too are carboxyl groups, the latter bind calcium ions strongly. This also contributes to the smooth product texture obtained after heating the milk or retentate.

While the presence of denatured whey proteins is an advantage in some cheeses, this is not the case with other varieties, e.g. presence of denatured whey proteins may be responsible for the lack of stretch in heated UF **Mozzerella** and reducing melting characteristic of UF cheeses e.g. **Havarte**.

F. UF cheese yields : As the level of solids in the retentate increases so does the difference between the yields of conventional and UF cheeses. The precise yield advantage depends on the variety of cheese being made. The closer the moisture content of the retentate is to the moisture content of the final cheese, the greater is the yield improvement. The economic viability of UF cheese making depends significantly on the yield increase. Overall yield increases of 40% have been claimed for some varieties.

G. Methods by which UF Cheese Making can Increase the yield : The weight of cheese manufactured from any given milk supply i.e. the yield is equal to the sum of the weight of SNF, moisture and fat in the product. UF cheese making can increase the weight of each of these components. The weight of SNF may be increased by the incorporation of extra water soluble (mainly whey proteins) into the cheese. If suitably designed equipment is used, the losses of casein in the form of fines may also be reduced. The weight of moisture may be increased by virtue of the presence of the extra SNF components. In some cases the moisture to protein ratio may be higher than in the traditional product. The weight of fat may be increased if cheese making equipment is used that reduces fat losses.

I. Whey Protein Retention and Yield : As a starting point, the extra whey protein retained in the cheese can be considered to increase the yield in the same way as an increase in casein retention improves the yield. Given that the maximum percentage of whey protein in milk is about 0.7% the principle of mass balance can be used to calculate the maximum yield advantage that can be obtained from the whey proteins, assuming that the moisture to protein ratio in the UF and conventional cheese are about the same calculation shows that the yield increase due to whey proteins depends on cheese variety but cannot be greater than 17%. Further increases in yield are possible, but only by reducing fat and casein losses and by increasing the moisture to protein ratio. Slight increases in this ratio are acceptable when denatured whey proteins are present in some

UF Cheeses.

J. Fat Retention and Yield : The fat losses occurring during manufacture of soft UF cheeses are minimal as very little whey is released from the coagulated retentate. Although a greater release of whey is required with hard UF cheeses the fat retention is claimed to be better than 95% provided specially designed cheese making equipment is used. Increase in yield, based on improved fat retentions are of most benefit with cheeses made from homogenized milk, such as blue cheeses, since homogenized fat cannot be recovered effectively from whey. However, in most cases milk is not homogenized and the bulk of the fat in the whey can be recovered for further processing. The recovered fat is usually about as valuable as the fat in fresh milk. In general, reductions in fat losses make a relatively minor contribution to the profitability of cheese making.

Varieties where UF Cheese Making is most successful : Cheese that have low pH values (pH 4.6-4.8), high moisture contents and do not depend primarily on proteolysis for flavor development appear to be the easiest to make from concentrated milk as judged by product quality. Yields are comparatively high because only a small amount of whey loss is needed to convert the retentate into cheese. The lack of quality problems may reflect the fact that at pH 4.6 the casein micelles have largely disintegrated. When micelles are in this form cheese texture may remain unaltered over a range of calcium levels. The casein matrix in cheeses where micelles have largely disintegrated may not be significantly disrupted by the presence of whey proteins especially when the matrix has a comparatively high moisture content. However, the success pattern doesn't include varieties that should stretch when melted and heated.

Conclusion : Increase in yield is due to retention in the cheese of proteins which are not coagulated by rennet i.e. the so called soluble proteins of milk. 80% of rennet is saved as it remains there in milk. This way it would also alleviate the present world wide shortage of rennet. Because of the membrane area which can held within a small volume, the number cubic meters necessary for accomodation of an UF apparatus in smaller than the corresponding draining room. Reduction in labour cost can be expected. Ultra filtrate (New whey) contain no problem, its polluting power represents only 80% of that of the traditional whey RO also minimizes environmental pollution through producing low BOD permeate. The normal BOD load of whey is around 45,000-55,000 ppm which is reduced to 600 ppm by the application of R.O.

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Cost Estimation For The Manufacture of Mellorine Type Frozen Desserts

by

K. L. Arora*, Kaushik Adhikari ** and N. K. Verma ***

The cost for the manufacture of mellorine type frozen desserts using groundnut-oil and hydrogenated fat was estimated and compared with that of the milk fat ice-cream. The cost for 100 ml of groundnut-oil and hydrogenated fat mellorines containing tween-80 and GMS was Rs. 1.11, 1.09, 1.09 and 1.04, respectively against Rs. 1.32 for control ice-cream and these were cheaper by 17-21 per cent.

Introduction

Process modification in the manufacture of Mellorine type frozen desserts wherein butter fat is substituted with low cost PUFA rich vegetable oils and fats is expected to reduce cost of final product substantially. Since butter fat accounts for nearly one third of the total cost of the final product, this will be extremely beneficial for the healthy growth of ice-cream industry. With this objective in mind, this study was undertaken to examine the reduction in cost off Mellorine type frozen desserts due to substitution of milk fat by the vegetable oils and fats.

Materials and Method

The Mellorine type frozen desserts and Ice-cream having the composition as given in Table 1 were manufactured using ground nut-oil, hydrogenated fat and milk fat respectively.

The cost estimates for these products were made as per guidelines of Peter and Timmerhaus (1968), case study by Patel and Arora (1976), Rajor (1980) and Bhushan (1987). For this purpose, the information for the financial year 1989 on various parameters was elicited from the records of Experimental Dairy and the Division of Dairy Economics, Statistics and Management, NDRI, Karnal.

To determine cost of production per unit, value added approach i.e. value added to raw materials in product transformation, was adopted so as to segregate processing cost from raw materials cost. The following conditionalities concerning the product mix were assumed.

1. An input of 90,000 liters of mix would yield 1,71,000 litres of frozen desserts/ice-cream with 90% overrun.

2. Manufacturing of 171,000 litres of Ice-cream would require running on machinery and equipment in three shifts of 8 hrs each for 300 days. The rest of the period was assumed to be utilised for the plant maintenance.

3. Manpower requirements for running the plant are as spelled out in Table 2.

4. Specific gravity of the mix was taken as 1.1. Therefore, the cost figures were worked out for 99,000 kgs of the mix.

The individual costs involved in the manufacture of Mellorine type desserts/ice-cream were recorded and categorized according to methodology specified below:

1. Raw materials: The costs of raw materials and other ingredients were taken at the prevailing market price during 1989 and allocated directly to the specific product.

2. Labour and supervision: Direct wages and salaries comprised this cost group. Since the manpower was utilised exclusively in making the product, total expanses on account of their employment were loaded to the product.

3. Utilities: The expenditure on power, steam and water were taken under this group. The cost on each item was determined as mentioned hereunder.

i) Power charges: An inventory of all the items of machinery and equipments run on

electricity was made and their power consumption was worked out on the basis of daily usage of the machinery and horsepower specification. The charges on electricity were worked out as the product of energy consumption and the rate at which it was available from the State Electricity Board.

ii) Steam : The total steam consumption for various activities like cleaning of equipment, pre-heating of the mix for homogenisation and pasteurization was estimated by the following method.

$$S_i = \frac{m \times S \times T}{L}$$

Where S_i stands for steam required in its operation

m = Quantity of mix in kg

S = Specific heat of mix

T = Temperature difference (in degree celsius)

L = Latent heat of steam

The specific heat of the mix was computed using the following equation suggested by the Harper and Hall (1976)

$$\text{Specific heat} = a + \frac{(1-a) \times W}{100}$$

Where a = constant and W stands for % water present in the mix

The water percentage in the mix was taken as 62.60 and a equals 0.20

Table 1 : Composition of Mellorine type frozen desserts

Composition	Groundnut-oil Mellorine		Hydrogenated Fat Mellorine		Control ice-cream
	Tween-80	GMS	Tween-80	GMS	Tween-80
Fat %	10	10	10	10	10
MSNF %	10	10	10	12	12
Na Caseinate %	1	1	1	Nil	Nil
Sugar %	12	12	12	15	15
Corn Syrup %	5	5	5	Nil	Nil
Stabilizer %	0.3	0.3	0.3	0.3	0.3
Emulsifier %	0.10	0.15	0.10	0.15	0.06
Banana Flavour, ml per kg mix	1.0	1.0	1.0	1.0	1.0
Colour, mg per kg mix	80	80	80	80	80

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Table 2 :
Total manpower requirement and its expenditure

Personnel	Number	Wages per person per month Rs.	Total expenditure per annum Rs
Manager/ Supervisors	3	4,000	1,44,000
Operators (Skilled)	3	2,000	72,000
Boiler operators	3	1,700	61,200
Refrigeration/ workshop personnel	3	2,000	72,000
Unskilled workers	9	1,000	1,08,000
Total :			4,57,200

The total steam consumption was arrived at as follows:

Total steam consumption

$$= \sum_{i=1}^n S_i$$

The cost off steam generation was worked out and applied to determine the cost off steam utilisation in the manufacturing process.

iii) **Water charges:** The charges for water used in processing as well as cleaning of equipments were computed at the flat rate of Rs. 100 per month and charged directly to the product.

4. Operating Supplies : This cost group included items which were used for house keeping jobs and other common items which could be identified with particular - centre.

Table 3 : Investment pattern on building, equipment and accessories

Building and other equipments	Original value (in lakhs of rupees)
1. Building	1.00
2. Batch pasteurizer:	1.25
3. Batch freezer:	1.50
4. Homogenizer:	7.00
5. Ageing Vats (2 Nos)	2.50
6. Hot water generating set:	0.50
7. Refrigeration and its accessories	4.50
8. Surface Cooler	0.40
9. Deep freezer (2 nos.)	1.00
10. Insulated van and other shipment material	3.00
11. Cans (10 Nos)	0.10

Table 4 : Electric energy consumption for different equipment and its expenditure

Equipment	Kw consumption per hr.	Operation (hrs. perday)	Total KWH hrs. per day
Pumps (4 Nos.)	2.984	8	23.87
Homogenizer (1 Nos)	7.460	6	44.76
Freezer (1 Nos.)	2.064	20	41.28
Freezer accessories	5.500	20	110.00
Surface cooler pumps	0.746	8	5.97
Refrigerated ageing vat	14.920	12	179.04
Deep freezers (3 Nos.)	3.096	20	61.92
Total KWH per day			466.84
KWH per year			= 1.40052 KWH
Cost of electricity @ Rs. 0.73 per KWH			= 1.40,052% 0.73
			= Rs. 1,02,238.

Table 5 : Total expenses incurred in processing

List of items	Amount (Rs)	% to total processing cost
1. Salaries	4,57,200	47.77
2. Electricity charges	1,02,238	10.68
3. Steam charges	8559	0.89
4. Water expenses	1000	0.11
5. Operating supplies	20,000	2.09
6. Quality Control	108,000	11.29
7. Depreciation on building and equipments	2,30,000	24.03
8. Administrative and Secretarial services	30,000	3.14
Total	9,56,997	100.00

5. Quality Control : The expenses on the maintenance of quality Control Laboratory were estimated assuming the requirement of one Supervisor, one Laboratory Assistant, one Attendant and the cost on the laboratory chemicals required for testing of samples.

6. Depreciation: Straight line method of calculating depreciation was used. The present value of the building and equipment was considered as per the guidelines of Rajor (1980) and Bhushan (1987). The useful life was assumed to be 40 years and 10 years for buildings and machinery/equipments, respectively.

7. Administrative and Secretarial services:

Salaries of administrative staff, telephone bills, stamps, cost of stationery items etc. comprised this group. A lumpsum amount of Rs. 30,000 was assumed to be adequate to meet the needs of dairy plant.

The reduction in cost in the manufacture of Mellorine type frozen desserts upon replacement of butterfat with other fat/oil was also worked out.

Results and Discussion

The compositional parameters of Mellorine type frozen desserts and Ice-cream are presented in Table 1. The machinery and

other equipments required to manufacture the products under consideration was given in Table 3. Cost on building was meager accounting for only 4.21 per cent of the initial investment.

The total manpower requirement and its expenditure on salaries and wages (Table 2) would be off the order of Rs. 4,57,200 per annum. Expenses on managerial/supervisory staff constitute about 32 per cent of total wage bill.

The expenditure on electrical energy consumption in running various equipment and machinery and those incurred in processing are given in Table 4 and 5, respectively.

The expenses on account of employment in the product manufacturing were the highest contributing about 48% followed by depreciation (24.03%) and quality control (11.3%). Utilities comprising of electricity, steam and water had aggregate share of 16 per cent in product transformation.

Table 6 depicts the total cost of manufacture of mellorine type frozen desserts/ice cream using different type of oils/fats and emulsifiers. The cost of manufacturing Mellorine containing hydrogenated fat and GMS was the lowest, Rs. 1.04 per 100 ml. The cost was Rs. 1.09 when emulsifier was only replaced with Tween-80. The costs of ground-nut oil Mellorine using Tween-80

Table 6 : Cost off Production of Mellorine type frozen desserts vis-a-vis Control Ice-Cream

Type of Oil / Fat used	Type of Emulsifier	Cost of raw materials (Rs)	Total cost of processing (Rs)	Aggregate Cost of manufacturing (Rs)	Total production (litres)	Total cost of manufacturing (Rs per 100 ml)
Hydrogenated fat	Tween-80	916495	956997	1873492	171000	1.09
	GMS	833641	956997	1790638	171000	1.04
Groundnut oil	Tween-80	939265	956997	1896262	171000	1.11
	GMS	918526	956997	1875523	171000	1.09
Butter fat	Tween-80	1299260	956997	2256257	171000	1.32

and GMS were Rs. 1.11 and Rs. 1.09 per 100 ml. respectively.

Mellorine type frozen desserts were found to be cheaper by 17-21% as compared to control ice-cream (Rs. 1.32) using butter fat.

The sizeable cost reduction due to replacement off butter fat with other fats/oils offers good scope to manufacture frozen desserts economically.

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Some Physico-Chemical and Sensory Characteristics of Beverage Developed from Defatted SoyafLOUR

by

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Abstract

The defatted soy flour from M/s Vippy Solvex Products Ltd. was used to prepare soy protein isolate using HCl as coagulant at pH 4.5 for the formulation of high protein beverage. The isolation of proteins resulted in some losses of minerals except sodium and vitamins. Soy protein beverage added with milk cream scored highest, however, it did not differ significantly ($P \sim 0.05$) with that made using groundnut oil whereas it differed significantly with those made using sunflower oil or hydrogenated vegetable fat.

Introduction

Even today, the protein deficiency remains the nutritional problem of most of the developing countries largely for the preschool children. The reason for this is either the short production/supply of cow/buffalo milk or the high cost of concentrated protein foods available in these countries. The relatively low cost of soybean protein as compared to animal protein and the simplicity of technologies by which it can be converted to palatable high protein foods make it suitable for use as a source of protein particularly in the developing countries where animal protein is beyond the reach of common man.

Defatted soy flour in the form of protein isolate could be used to tailor an acceptable protein beverage. Schapiro (1980) developed a mix using soy protein isolate, sodium calcium caseinate and whey powder which could be mixed with water, milk, fruit juice etc. to yield a nutritious beverage. Patil and Gupta (1981) prepared flavored protein rich beverage from whey and soybean. Szezesriak and Schetz (1984) developed fruit flavoured beverages by using soy protein hydrolysate to improve mouth feel. Bily (1985) prepared nutritious food product based on the utilization of soy protein isolate. Singh et al. (1991) isolated soy protein using different coagulants and coagulation pHs. The limited information is available on the use of wet soy protein isolate for the development of beverage. Therefore, the present study was aimed to utilize the wet isolate directly in the formulation of high protein beverage and to evaluate its physico chemical and sensory characteristics.

Materials and Methods

Defatted soy flour was obtained from M/s Vippy Solvex Products Ltd., Dewas, M. P. India.

Soy Protein Isolate

It was prepared by the method described by Singh et al. (1991) using HCl as coagulant at 4.5 pH.

Preparation of Soy Protein beverage

The recipe used in the formulation of soy protein beverage was : water, 85.5 per cent; soy protein isolate (d. b.), 3.5 per cent; sugar, 8.0 per cent; fat, 2.5 per cent; emulsifier, 0.1 per cent; salt, 0.05 per cent; vit B₁, 2.5mg per litre and Vit B₂, 1.5 mg per litre. The ingredients were mixed and heated to 100°C, adjusted to 7.0 pH, stirred vigorously for 15 minutes and homogenized at 3000 psi at 65°C using homogenizer (Gaulin Corporation, Model No. 5T8S SMD). The beverage was then boiled for 2 min. followed by instant cooling to 5-7°C and added with flavour. The beverage samples were subjected to various physicochemical and sensory properties. The effects of different types of fat i.e. vegetable

fat, sunflower oil, groundnut oil and milk cream were studied on sensory properties of beverage.

Proximate Composition

Moisture, total ash and protein in defatted soy flour, protein isolate and soy protein beverage were determined by using standard AOAC (1970) methods. Fat content in defatted soy flour and dried isolate was determined by soxhlet extraction method of AOAC (1970) whereas that in soy protein beverage by Gerber method described in IS: 1224 (Part I) 1977.

Nitrogen Solubility Index (NSI)

AOCS (1969) method was used to determine nitrogen solubility index.

Minerals

Calcium, Phosphorus, Iron, Sodium and Potassium were determined by using standard methods described by Ranganna (1986).

Vitamins

Thiamine and riboflavin were determined by the standard AOAC (1976) method which

Table 1. Physico-Chemical characteristics of defatted soy flour, protein isolates and its beverage.

Analysis	Defatted soy flour	Soy protein isolate (d.b.)	Soy protein beverage (w.b.)
Moisture, %	-	-	86.40
Protein, %	58.74	96.31	3.20
Fat, %	1.3	-	2.00
Ash, %	8.04	1.57	0.40
Carbohydrate, % (by difference)	31.74	2.12	8.00
Minerals, mg %			
Calcium	190.0	12.0	37.00
Phosphorus	660.0	570.0	52.00
Iron	17.0	12.0	2.50
Sodium	28.0	65.0	23.00
Potassium	2170.0	36.0	11.50
Vitamins, mg %			
Thiamine	1.15	0.98	0.12
Riboflavin	0.37	0.21	0.16
In vitro digestibility %	68.6	62.4	56.10
pH	-	-	6.90
Acidity, % lactic acid	-	-	0.05
Viscosity, cp	-	-	5.00
Specific gravity	-	-	1.144

All values are means of two determinations.

Table 2 : Sensory scores obtained after converting ranks for the effect of fat type on overall acceptability of soybean beverage.

Judges	Soy protein beverage added with			
	Ground-nut oil (T ₁)	Milk cream (T ₂)	Sunflower Oils (T ₃)	Vegetable fat (T ₄)
1	0.30	1.03	- 0.30	- 1.03
2	0.30	1.03	- 1.03	- 0.30
3	0.30	1.03	- 0.30	- 1.03
4	0.30	1.03	- 0.30	- 1.03
5	0.30	1.03	- 0.30	- 1.03
6	0.30	1.03	- 0.30	- 1.03
7	0.30	1.03	- 1.03	- 0.30
8	1.03	0.30	- 1.03	- 1.03
9	1.03	0.30	- 1.03	- 0.30
10	1.03	0.30	- 1.03	- 0.30
Mean	0.519	0.811	- 0.592	- 0.738

Least significant difference at 5% level of significance = 0.519

T₁ 0.811^a T₂ 0.519^a T₃ - 0.592^b T₄ - 0.738^b

Any two values not followed by the same letter are significantly different at 5% level

are based on fluorometric measurement of thiochrome after oxidation of thiamine and of riboflavin after oxidation of interfering substances, respectively.

In-vitro digestibility of soy proteins

It was determined with pepsin and pancreatin enzymes by using the procedure of Akesson and Stahmann (1964) and De-Groot and Slump (1969).

Viscosity

The viscosity of the beverage sample was determined by using Brookfield-synchroelectric visometer (Model LVL). This instrument is based on the measurement of resistance offered by the test material to a spindle immersed in it.

Specific gravity

The specific gravity of beverage was measured at 84°F with the help of specific gravity bottle and the results were corrected for 20°C.

Acidity

The acidity was determined using APHA (1960) method.

Sensory Evaluation

The samples of beverage were presented to an untrained laboratory panel consisting of 10 members to record their preference for the samples by ranking test. The best sample was ranked first and least the last. Each panelist was provided with a score card to record his performance. The data of ranking test were converted to sensory scores and subjected to statistical analysis using ANOVA technique

described by Larmond (1982).

Results and discussion

Physicochemical characteristics of defatted soy flour, protein isolate and its beverage.

From the results presented in Table 1, it can be seen that protein content was higher in protein isolate whereas minerals except sodium and vitamins were higher in defatted soy flour, indicating the loss of these nutrients during isolation of proteins. The higher sodium content in isolate may be due to the incorporation of sodium ions during the preparation of isolate. The values for proximate compositions, minerals and vitamins in defatted soy flour and soy protein isolates are in accordance with those reported earlier (Horan, 1974; Kellor, 1974; Chauhan & Bains, 1985; Dublisch et al. 1988; Kaushik et al. 1987 and Nepal Singh, 1988; Mattil, 1974; Madan Mohan, 1985; Lawhon et al., 1981).

Formulation and Preparation of Soy Protein beverage

In the formulation of beverage, the amount of isolate added was based on the level of protein content required to be in the final beverage (3-3.2 per cent). The level of sugar and salt are based on the preliminary sensory trials of the beverage.

From the results of Table 2, it can be revealed that soy protein beverage added with milk cream and groundnut oil did not differ significantly ($p \sim 0.05$) from each other with respect to their acceptability. However, soy protein beverage added with milk cream and groundnut oil differ significantly ($p \sim 0.05$) with soy protein beverage added with sunflower oil and hydrogenated vegetable fat.

From the results of this investigation it can be concluded that an acceptable nutritious beverage can be developed from defatted soy flour if used in the form of wet protein isolate. In the formulation of beverage slightly higher amount of sugar (8 per cent) was required. The addition of 0.05 per cent salt made it more palatable.

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Determination of Process time for Cold-break Tomato Juice

by

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Abstract

Process times were determined for bottled cold-break tomato juice. Juice, immediately after cold extraction, was boiled for 1 min to inactivate pectin methyl esterase. It was adjusted to 6% TSS using cane sugar, 0.6% acidity with citric acid and 0.8% NaCl content on the basis of sensory evaluation results. Cold-point of bottled juice was found to be at a point 9.5 cm from cap-end on the central axis of the bottle (bottle capacity 200 ml, mouth dia 1.5 cm and height 19.7 cm). Process times for juice (pH 4.3-4.4) were based on $F_{18} = 0.7$ min (for *Bacillus coagulans*) processing temperature of, 240°F (116°C) and retort come-up time of 6 min. For cold-filled juice it was found to be 11.9-12.6 min by formula method and 14.1-16.6 min by graphical method. The corresponding values for hot-filled juice were 11.9 and 12.6 min respectively. Bottled juice processed for 11 min or more were found to be sterile, and they retained their quality attributes well during 90 days storage under ambient conditions.

Introduction

Tomatoes are perishable commodity. Their shelf-life is limited to about a week even under refrigerated storage¹. Hence, they are either consumed fresh or processed into products such as puree, paste, ketchup and sauce. For most of the tomato products, juice is the basic ingredient. In addition, tomato seeds are economically important since they are needed by farmers. When viability of seeds is to be maintained, the juice is extracted by cold-break process. However, this process reduces viscosity of juice due to action of pectinases². To overcome this problem, whole tomatoes may be scalded for 60-90 seconds in boiling water³. This process loosens the skin from flesh without affecting the viability of seeds and yields more juice. However, soft-ripe tomatoes which are good for seed purposes yield juice lacking tomato aroma and taste. The quality of juice from different batches also

varies due to compositional changes. Consequently, the present investigation was taken up with the object of developing a palatable juice obtained by cold-break method and to standardize a schedule for its in-bottle processing.

Experimental

Juice extraction

Soft ripe, dark red tomatoes were sorted to remove infected or damaged fruits, washed with water, trimmed to remove stem, greenish or damaged portions, and sliced. Both cold-break and hot-break procedures were used for extraction of juice. The extracted juice was strained through 20 mesh sieve to remove seeds, peels, etc. Cold-extracted juice was quickly boiled in a stainless steel vessel for 1 min. This heat treatment has been reported to be sufficient to inactivate pectin methyl esterase (PME), the pectin degrading enzymes⁴.

Standardization of juice

Cold-break juice at natural pH was adjusted to TSS levels of 5.0, 5.5, 6.0, 6.5 and 7.0° Brix by adding appropriate quantities of cane sugar, acidity adjusted to 0.4, 0.5, 0.55 and 0.6% using 20% citric acid solution, and sodium chloride to 0.2, 0.4, 0.6, 0.8 and 1.2%. The most acceptable levels of these

ingredients were determined by sensory evaluation and the juice was standardized to these levels for further studies.

Table 1:

Chemical composition of cold-break tomato juice

Constituent	Range
Moisture (%)	94.0 - 95.4
TSS (°Brix)	4.0 - 4.5
Fat (%)	Traces
Protein (%)	0.73 - 1.58
Sugars	
Reducing (%)	1.43 - 1.62
Total (%)	2.52 - 2.75
Ash (%)	0.478 - 0.598
Acidity (as % anhydrous citric acid)	0.41 - 0.59
pH	4.05 - 4.80
Ascorbic acid (mg/100 g)	1.20 - 2.03
Pectin (as % calcium pectate)	0.165 - 0.295
Lycopene (mg/100 g)	4.057 - 4.837
PME activity (PE units/ 100 ml)	4.426 - 5.128

Heat penetration studies

The standardized juice (6.0% TSS, 0.6% acidity and 0.8% NaCl) was filled at room temperature in 200 ml. soft drink bottles (outer length 19.7 cm and 1.5 cm mouth diameter). The bottles were sealed with PVC lined crown corks fitted with nonprojecting

Table 2 :

Sensory evaluation of cold-break tomato juice adjusted to different TSS, acidity and NaCl levels.

	Score for				
	Colour	Aroma	Mouthfeel	Taste	Total score
TSS (°Brix)					
5.0	2.43	1.10	1.10	2.84	7.47
6.0	2.43	1.15	1.10	2.97	7.65
7.0	2.43	1.12	1.08	2.71	7.34
Acidity (% anhydrous citric acid)					
0.4	2.46	1.16	1.13	3.24	7.98
0.5	2.46	1.07	1.16	3.04	7.73
0.6	2.46	1.13	1.17	3.32	8.08
NaCl (%)					
0.4	2.55	1.20	1.15	2.24	7.14
0.6	2.55	1.13	1.10	3.04	7.82
0.8	2.55	1.22	1.22	3.20	8.19
1.2	2.25	1.10	1.15	2.66	7.16

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Table 3 : Heat penetration characteristics and process times for bottled tomato juice processed in retort at 116°C and cooled in water.

Processing condition	Initial Temp (°F)	Come-up time (min)	Parameters of heat penetration curves					g	Process time		
			f_h (min)	j_h	T_o (°F)	f_c (min)	j_c		Formula CT ¹ (min)	Method AT ² (min)	Graphical Method (min)
Steam heating	83	6	12.2	0.871	103	17.3	2.91	9.276	14.3	11.9	16.6
Water heating	84	6	10.8	0.670	135	26.3	3.35	4.300	15.0	12.6	14.1
	135	6	10.0	0.615	175	20.7	2.04	6.129	14.3	11.9	12.6

¹Calculated time.

²Actual time corrected for come-up time.

plug-in needle type Ecklund thermocouples. The thermocouples were connected through a selector switch to a Leeds and Northrup temperature potentiometer. The bottles were retorted at 240°F (116°C) and cooled by shutting off steam supply, with-drawing hot water and simultaneously injecting cold water slowly. The temperatures of bottles and the retort were recorded during heating and cooling at intervals of 2 min till the bottles attained a temperature of about 236°F (114°C) during heating and about 100°F (38°C) during cooling.

To determine the cold-point during processing, thermocouples were positioned at 4.2, 6.5, 6.7 and 9.5 cm from the top and heat penetration studies were carried out. Thermocouples at position 9.5 cm was found to be cold point and subsequent heat penetration studies were carried out by positioning the thermocouples at that position. Juice was filled cold (83-84°F or 28-29°C) or hot (135°F or 57°C), and the retort was brought to the processing temperature in the following three ways.

1. Filling the retort with tap water, immersing the juice bottles at room temperature and injecting steam,
2. Preheating the retort and water to about 135°F (about 57°C) by steam injection before immersion of bottles and
3. Keeping the bottles in retort at room temperature and steaming.

Steam supply rate was regulated to achieve come-up times of 6 min.

Process time calculations

Process time was calculated by Graphical and Formula methods⁵. Since the pH of the juice ranged between 4.3 and 4.4, the calculations were made using $F_{18}^{250} = 0.7$ min. the sterilization value of the process based on *Bacillus coagulans* as the test organism⁶. The slowest heat penetration data were used in these calculations.

In graphical method, lethal rates (reciprocal of F values) corresponding to the temperatures prevailing in the container during heating and cooling were plotted against time, and curves drawn parallel to the cooling portion of the lethality curve, weighing

in an analytical balance and dividing this weight with the weight of the paper equal in area to unit sterilization from the same paper. The process times equivalent to unit sterilization were found from the graphical interpolation curves of F values Vs process times and were corrected for come-up time.

The formula of Ball⁵ was used for process time calculation, Effectiveness of come-up time was assumed to be 42%.

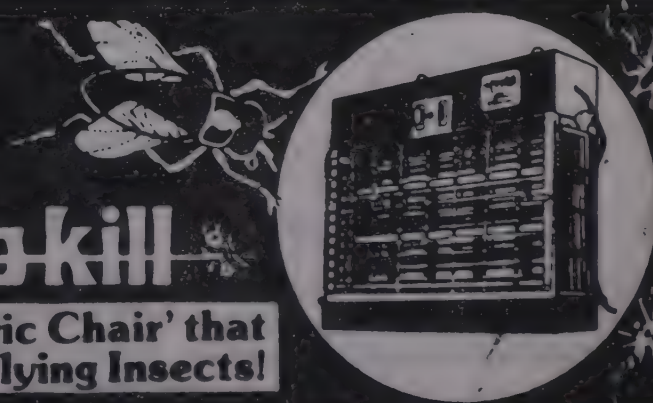
Experimental pack studies

The standardized, cold-break tomato juice at room temperature was filled into soft drink bottles, sealed with crown corks and processed at 240°F (~116°C) for 11 or 13 min. in retort filled with preheated water. The bottles were stored at room temperature (25-35°C). The samples were analysed for

TSS, acidity, pH, proteins, sugars, pectin, lycopene and NaCl by the procedures described by Ranganna⁷. Sugars (reducing and non-reducing) were determined by Shaffer-Somogyi method, and pectin content by Carre and Heyanes method. PME activity was estimated according to the method described by Nath and Ranganna⁸. The acceptability of the juice was determined by sensory evaluation⁷.

Microbiological examination

Bottles of juice processed for 0, 5, 11 and 13 min at 116°C as described above were incubated at 37°C for 15 days and at 55°C for 7 days. They were examined for gas production total count, *B. coagulans* count, coliform count, yeast and mould count and change in acidity by A. P. H. A. method⁹.



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Table 4: Changes in quality of bottled tomato juice processed for 11 and 13 min at 116°C and stored for 45 days at room temperature (25-35°C).

	Protein (%)	Sugars Reducing (%)	Total (%)	Pectin (%)	Lycopene (mg %)	PME activity (PEU / 100 ml)
Before processing	1.47	1.24	3.89	0.158	4.213	7.44
Processed for 11 min and stored for Days						
0	0.88	1.14	3.34	0.104	2.965	Nil
15	0.88	1.09	3.30	0.103	2.965	Nil
30	0.88	1.07	3.30	1.103	2.965	Nil
45	0.85	1.03	3.30	0.103	2.933	Nil
Processed for 13 min and stored for Days						
0	0.83	1.08	3.11	0.102	2.653	Nil
15	0.83	1.06	3.11	0.102	2.653	Nil
30	0.83	1.05	3.09	0.102	2.653	Nil
45	0.81	1.00	3.02	0.102	2.621	Nil

¹During processing and storage the TSS, acidity, and NaCl concentration of tomato juice remained almost unchanged at 6°Brix, 0.6% and 0.8% respectively.

Sensory evaluation

The acceptability of the sample was determined by carrying out sensory evaluation using a 9 point scale. On this scale 1 represented 'dislike extremely' and 9 presented

'like extremely'. The panelists evaluated the samples for their colour, aroma, mouth feel and taste. These quality attributes were assigned a weightage of 30, 15, 15 and 40 per cent respectively according to the modified score card of U. S. D. A. ¹⁰ and summed up to determine the overall acceptabilities of the samples.

Results and discussion

Chemical composition

The percentages of moisture, TSS, lycopene, protein and ash in cold-break tomato juice (Table 1) were in agreement with the reported values^{3,11}. However, reducing and total sugars values were lower than those reported by Salunkhe¹¹ and Kaur et.al.¹² Gould¹³ and Centarelli¹⁴ have reported higher ascorbic acid (AA) content in tomato juice than obtained in the present study (5.45 mg/100 g). During extraction by cold break method, AA level reduced to 1.20-2.03 mg/100 g (Table 1) and it was completely lost during processing. The PME activity (Table 1) was found to be higher than those reported by Nath et.al.⁴ and Tripathi¹⁵.

Standardization of Juice

Composition of tomatoes has been reported to vary with variety and agro-climatic conditions. To overcome this variability, juice was standardized by adding appropriate quantities of cane sugar and citric acid. Common salt (sodium chloride) was also added to improve the taste and aroma of juice. Quantities of these three ingredients for best quality juice was optimized through sensory evaluation (Table 2). The three sensory attributes, i.e. aroma, mouthfeel and taste were found to be affected only slightly by the addition of sugar, acid and salt, and there was no significant difference between their sensory scores. Though variations in the levels of sugar and acid changed the total

score by only 0.31 and 0.35, respectively, juice with 6.0% TSS and 0.6% acidity was used in further studies because this sample got the highest score. Juice with 0.8% NaCl was liked most by the panelists (Table 2). This concentration is higher than that being used commercially (0.5-0.7% NaCl) ¹⁶.

Heat penetration in bottled juice

The cold point of bottled tomato juice was found to be on the central axis at a point 9.5 cm from the top (or 8.9 cm from the bottom). The come-up time for retorts was 6 min (Table 3). Changes in the temperatures of retort and the bottles are shown in Fig. 1.

Heat penetration curves, plotted on a semilog paper were straight lines after the initial lag period (Fig. 4). The f_h values ('slopes' of heating curves) ranged from 10 to 12.2 min and were lower than the corresponding values for f_c ('slopes' of cooling curve) (Table 3).

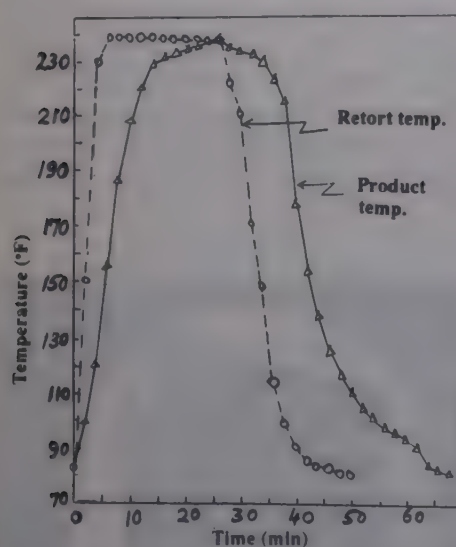


Fig 1. Heat Penetration curve for bottled cold-break tomato juice filled at 83°F and processed in steam under 10 psig steam pressure (come-up time 6 min).

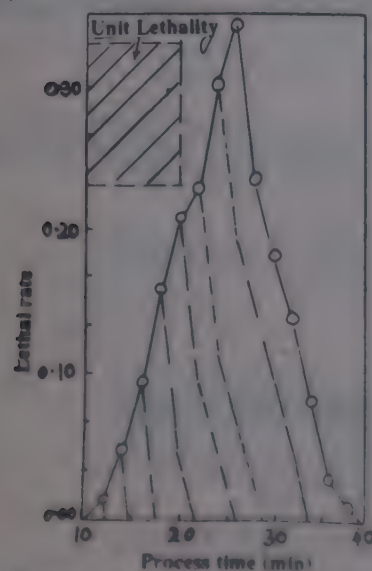


Fig 2. Lethal rate curve for bottled cold-break tomato juice based on Fig 1.

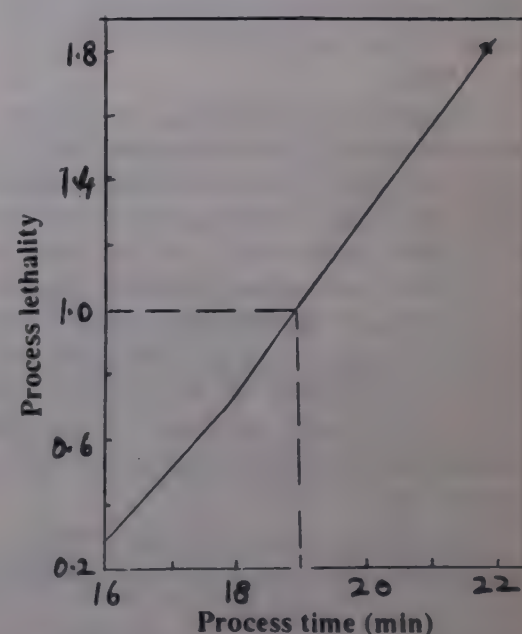


Fig 3. Lethality vs process time curve for cold-break tomato juice based Fig 2.

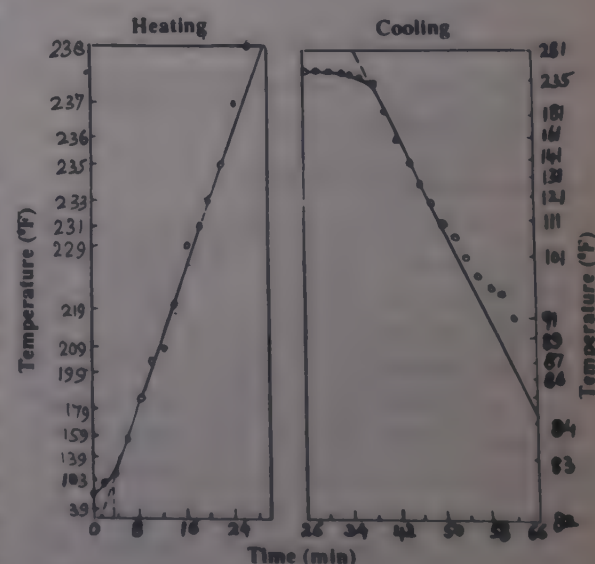


Fig 4. Semi-log plots of heating and cooling curves for cold-break tomato juice filled at 83°F and processed in steam under 10 psig stem pressure (come-up time 6.0 min).

Process time

For calculation of process times by Graphical Method, lethality curves were drawn for this organism (Fig. 2) and the process times for a F_{250}^{121} of 0.7 (F value of *Bacillus coagulans*) were obtained from the corresponding F value vs process time curves (Fig. 3). These process times varied from 12.6 to 16.6 min depending upon the processing conditions (Table 3).

In the formula of Ball⁵ for process calculation, f_0 has been assumed to be equal to f_c and j_c as 1.47. In the present study, the values of j_c ranged from 2.04 to 3.35. Hence, $f_0/U: g$ tables of Stumbo¹⁷ were used, and the values of g were obtained by extrapolation as j_c were more than 2.0 (the maximum limits given in the above tables). Process times corrected for the retort come-up times varied from 11.9 min to 12.6 min (Table 3). These values were lower than the corresponding values obtained by the graphical method. The differences between the process times obtained by the two method ranged from 0.7 to 4.7 min.

Storage changes in processed juice

The bottled cold-break tomato juice filled at room temperature was processed at 240°F (116°C) for 0, 5, 11, 13, 15 and 17 min and incubated. The juice processed for 0 and 5 min spoiled within a few days. Morphological examination of colonies picked from the total count plates showed a mixed flora. However, samples processed for 11, 13, 15 or 17 min and incubated at 98.6°F at (37°C) or 131°F (55°C) did not show any sign of spoilage and subsequent microbiological examinations showed them to be sterile.

Two sets of bottled tomato juice were processed again for 11 and 13 min, the minimum process time, which had not shown any sign of spoilage in an earlier study. They were stored under ambient conditions upto a period of 45 days and analysed. Storage was found to result in reduction in the protein, sugar, pectin and lycopene contents (Table 4). Maximum changes were observed in protein and lycopene contents. Changes were more in the juice processed for longer period (13 min). Further changes observed during storage at room temperature for 45 days were not appreciable. Juice processed for either time was found to be devoid of PME activity.

Sensory evaluation of the bottled juice stored for 90 days at room temperature showed that the products had retained their organoleptic qualities very well except for colour which was rated slightly inferior. Total score recorded by juice processed for 11 min was 8.17 as compared to 7.14 for 13 min samples.

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Storage Related Changes In Physico-Chemical Properties of Lactose Hydrolysed Infant Formula, — A Review : Paper II

by

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Any infant formula with hydrolysed lactose and PUFA enriched fat needs special attention for its storage, especially in tropical countries, like India where the summer temperature may go as high as 47°C. Such formulas when stored at ambient temperature may undergo several protein-protein, protein-carbohydrate and protein-lipid interactions during storage which finally alter the physico-chemical and nutritional characteristics of the product. Such changes in physico-chemical properties viz, colour flowability, reconstitutability, protein and fat profiles of spray dried lactose hydrolysed infant formula during storage have been reviewed in the article.

Changes in colour:

The changes in colour have known to be affected by the amount of reducing sugars and proteins present in the formula. The method of drying and storage conditions, especially temperature and humidity also influence the changes in colour during storage.

Development of browning occurs in dried milk during storage (King, 1966). Dried milk, exposed to atmosphere, underwent more rapid discolouration than the gas-packed powders, and when stored at 37°C for more than 2 months, suffered a change in colour with simultaneous loss of lysine (Adrian, 1972). Browning was also evidenced in spray dried lactose hydrolysed skim milk powder when stored at 40°C (Cobos Segarra, 1979). In another study, Kopecky (1978) however, reported that the browning of milk powder was enhanced by the increase in moisture content and temperature during storage.

Since non-enzymic browning is a spontaneous chemical reaction and starts well early in the manufacturing process, it may even be continued in the storage leading to discolouration of the product. In lactose hydrolysed infant formula having more amount of reducing sugars, glucose and galactose resulted through hydrolysis of lactose, the intensity of such discolouration increases with the increase in the period of storage (Paul and Mathur, 1992).

Changes in Flowability :

The changes in flowability of any product during storage depend on the moisture uptake by the product which results in lump formation and caking. The flowability of milk powder was observed to be affected during storage (Baldwin, 1977). An increase in the moisture content during storage may decrease the flowability of the powder (Peleg, 1977). The type of packaging material, therefore, plays an important role regarding the changes in flowability. The changes observed if any, during storage shall mainly arise due to moisture absorption by the product or release of free fat in lactose hydrolysed infant formula.

Changes in Reconstitutability :

Wettability :

A reduction in wettability was evidenced during storage of dried whole milk powder (Litman *et.al.*, 1956; Jensen and Hansen, 1978; Kuznetsov, 1979). The reduction of wettability during storage might be due to high content of released free fat in the dried milk samples (Iasztity *et.al.*, 1980). Paul and Mathur (1982) also evidenced reduction of wettability with the increase in degree of lactose hydrolysis as well as with the period of storage at 37°C.

Dispersibility :

Anon (1976) and Kuznetsov (1979) found that reduction in dispersibility or dissolution rate in dried whole milk during storage resulted with the increase in the free fat component of the powder. Jensen and Hansen (1978), however, reported that storage of dried whole milk powder had very little effect on dispersibility. Spray dried lactose hydrolysed infant formula also showed a decreasing trend in its dispersibility characteristics with the progress in storage which is reported to be due to the increased extent of protein-protein and protein-carbohydrate interaction. (Paul and Mathur, 1992).

Solubility :

The solubility of spray dried skim milk powder with moisture content of 3 to 5 percent, remained unaltered even after stor-

age of 700 days at 37°C (Lea and White, 1948). Work carried out by Jensen and Hansen (1978) indicated that dried whole milk stored at 50°C did not show any changes in solubility index. The decrease in protein solubility during storage of a spray dried lactose hydrolysed milk powder might be due to the formation of insoluble complex through protein-carbohydrate interaction (Cobos Segarra, 1979). Paul and Mathur (1992) also evidenced similar results in case of lactose hydrolysed infant formula during storage.

Changes in Proteins :

The milk protein has been found to undergo several changes during storage. No change in gel filtration behaviour was observed during initial stages of storage, however, some changes were observed after 5 days of storage (Furukawa and Yamanaka, 1972). Saprygin and Ivanov (1974) studied the changes in electrophoretic patterns of proteins in dried milk during storage and reported that the proportion of beta-casein and beta-lactoglobulin decreased appreciably with the extent of storage period. They further reported that such decrease was more pronounced in samples stored at 0.38 percent moisture than in those stored at relatively higher moisture content. Nedelkovitis and Truyen (1978) and Kelly (1981) also evidenced protein-protein interaction during storage. Work carried out by Cobos Segarra (1979) and Paul and Mathur (1992) indicated that on storage both spray dried lactose hydrolysed milk powder and infant formula lost most of the available lysine. Certain important changes do occur during the storage of spray dried milk products. Besides, proteins do participate in self interactions as well as with other components present in the system.

Changes in Fat :

The changes in fat during storage mainly depend upon the lipid make-up of the product, temperature relative humidity (RH) during storage and packaging material.

Changes in free fat :

The storage conditions affects the free fat

reorientation in dried milk (King, 1957). During storage, free fat content was reported to be affected mainly by moisture content, being insignificant when samples retained their initial moisture content (Tran, 1975; Korhonen *et.al.*, 1976; Kopecky, 1978). In another study, Lasztity *et.al.* (1980) reported that storage temperature had less significant effect than RH in the reorientation of free fat content of the dried milk powder. Paul and Mathur (1992) also evidenced marginal increase in the free fat content of spray dried lactose hydrolysed infant formula during storage at 37°C over a period of 12 months. They reported that maltodextrin layer around the fat globules possibly minimised the rupture of fat globule during storage.

Changes in iodine value :

Iodine value indicates the degree of unsaturation in the fat content of any product. In unsaturated vegetable fat rich dried infant formula, the iodine value was reported to decrease during storage (Druzhinina and Burova, 1976). Dutta (1981) also evidenced such decrease in the iodine value in PUFA rich infant formula during storage.

Changes in peroxide value:

Peroxide value indicates the extent of fat oxidation. Druzhinina and Burova (1976) observed only a slow increase in the peroxide value of infant formula when stored at +5°C and -5°C. In another study, Tolstukhina and Aristova (1979) reported higher rate of oxidation in surface fat during the storage of milk powders. Dutta (1981) also reported a rapid increase in the peroxide value in PUFA rich infant formula.

Changes in thiobarbituric acid (TBA) value:

Like peroxide value, TBA value also indicates the degree of fat oxidation. Jensen *et.al.* (1978) reported that TBA value of dried whole milk powder changed during storage. Tuohy *et.al.* (1981), on the other hand, reported that spray dried milk with 27 percent fat, packed under air in polythene bags and stored at 37°C, displayed a TBA value greater than 0.05 after 24 weeks of storage.

Other changes :

The changes in pH and moisture content of infant formula during storage were observed by Druzhinina and Burova (1976). They reported that on storage at +5°C and -5°C, there was a very slow change in these two parameters. No significant change in these two characteristics was observed in spray dried lactose hydrolysed infant formula during storage at 37°C over 12 months of storage when double gas (N₂) packed in tin containers (Paul and Mathur, 1992). The available lysine content however decreased progressively while hydroxy methyl furfural showed a progressive increase during storage of spray dried lactose hydrolysed infant formula (Paul and Mathur, 1992). The effect of storage on the vitamin content of dried milk, on the survival of different types of bacteria and nutritive value of proteins were evidenced by Paruelle *et.al.* (1980). Ivanov *et.al.* (1982) reported that the content of betacarotene, vitamin A, thiamine and riboflavin in infant formulas 'Bebe 0' and 'Bebe 1' did not change significantly at room temperature during a storage of one year. They further reported that the changes in the content of Na⁺, K⁺, Ca⁺⁺ and P⁺⁺⁺ were within internationally accepted limits. Work carried out by Pahwa (1982) indicated that there were 83.22 and 67.45 percent survival of bifidus flora during 12 months at room temperature and 37°C, respectively. A low temperature of storage of bifidus flora added infant formula would probably favour higher retention of the viability of bifidus microorganisms (Kilara *et.al.*, 1976; Pahwa, 1982).

It may be summarised that at low temperature, spray dried lactose hydrolysed infant formula may undergo less changes in colour and reconstitution properties of the product. It may further be concluded that like storage temperature, the initial moisture content and RH during storage also effect the physico-chemical characteristics of the spray dried formula. However, proper method of production and packaging system, controlled temperature and humidity during storage limit such changes in the formula.

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Modern Technology for Cleaning and Grading of Seeds for Food Processing Industry

By

Shri L. D. Patel
Managing Director
Goldin (India) Equipment Pvt. Ltd., Baroda

Day by day, consumers are becoming quality conscious about food, not only about appearance but also about food free of contamination. The basic raw materials i.e. whole seeds/grains/spices for any finished food products come from farms where all sorts of impurities are part of raw materials. The types, shapes, varieties, characteristics of all these impurities are of so varied a nature, that they cannot be separated by one stage process or by one machine.

From very ancient times, people have tried various methods of separating these impurities such as air winnowing, sieving etc. In good old days, these were carried out manually by families in small lots.

In the present time, every family is preoccupied with their various activities in their day to day life that they need ready processed foods and in order to supply the food on bulk scale, it became essential to mechanise cleaning & grading / processes requirements. The main topic of this paper is to present to you various methods and machineries for cleaning and grading of grains / seeds / spices.

Raw material of seeds contain.....

- (1) Fines / dust, sand etc.
- (2) Lights such sticks, stem, leaves, hulls,

etc.

- (3) Stones/Mud balls, metal pieces, etc.

- (4) Unmatured seed/shrivelled seeds/damaged seeds/bird - eaten seeds, etc.

- (5) Weed seeds.

For removal of (1) & (2) impurities, a screener machine with aspiration system is most suitable. A two deck screener removes oversize heavy impurities from top of first deck and fines/sand is removed from bottom of second deck. Light impurities are aspirated away by a fan and collected into a cyclone. This unit also provides a dust-free working in the plant. This machine with one additional deck can also provide facility of grading big seeds and small seeds. As for separation of (3) impurities, a destoner is most suitable. It works with combination of mechanical movement and air floatation and with proper adjustments of speed, feed, air and deck inclination, stones/heavy impurities are taken on one side and cleaned seeds go to the other side.

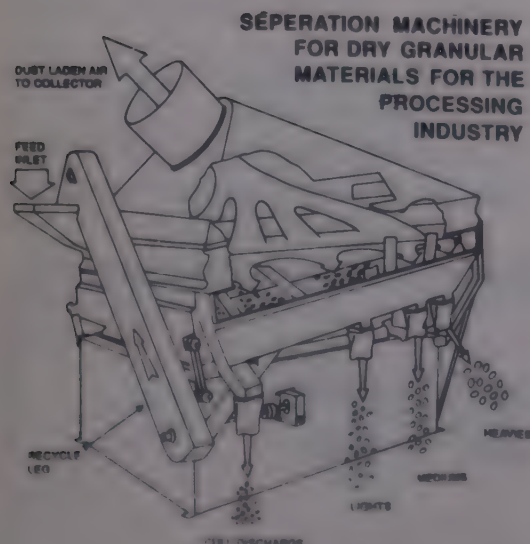
The most difficult separation is no. (4) impurity. This is best achieved on gravity separator. As the name suggests, it does the job of separation on the principle of specific gravity, difference of weights, basis be-

tween good/bold seed and damaged/wrinkled seed. The machine has many adjustments like air, feed, speed, inclination of deck, torque etc., which facilitates to get best separation of good seeds from the given lot.

As regards separation of weed seeds; if it is almost identical in size and specific gravity of crop seeds, then special machinery is required, depending upon physical characteristics of the weed seeds such as surface texture, colour, shape, etc.

Now, cleaning and grading of seeds is a must to control foreign matter/impurities in food products. Almost all food industries, flour mills, rice mills, grain packer, exporters etc., use these machineries to ensure quality food products to their clients keeping general application of seeds in mind. With a mechanized plant provided with most modern technological processing machinery, industry can achieve good quality end products not only free of foreign matters but also first grade bold seeds.

In case of seeds processing industry, final grade of seeds improve germination considerably. In case of spices seeds, it can produce an export quality material. In case of edible oil plant, it can produce silica free oil and cake.



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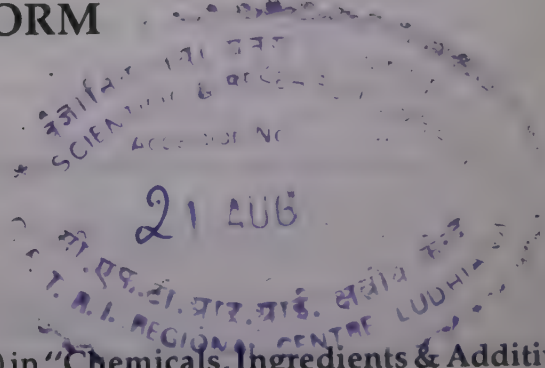
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NEWS & NOTES

NEW REFRIGERATION TECHNIQUES TESTED OUT

Leading refrigerator manufacturers in Germany are currently on a pilot project to test out a new refrigeration system. In this system, the cells of the insulating polyurethane foam embody an insulating gas that has unique properties.

Developed by Bayer AG, the new cell gas, HFKW 356 is distinguished by two qualities: it is not harmful for the ozone and its thermal conductive properties of 0.0095 W-mK (kilocalories/metre-second) at 25°C are marginally higher than conventional insulating gases.

Further, it is non-inflammable and does not diffuse from the foam even after many years. It is easily installed in on-going systems since it can be incorporated into current construction and engineering processes. HFKW 356 provides a forward-looking solution for cooling and freezing

units in that it uses an FFC refrigeration cycle. Thus it meets the universal requirement for environmental compatibility and low energy consumption.

ASIA'S BIGGEST AGRO-MARKETING YARD IN KARNATAKA

Asia's largest agricultural produce marketing yard is coming up on a 500-acre site at Hubli in northern Karnataka. The Rs. 15 crore yard will be ready in April this year.

Three more yards, a Rs. 20 crore yard on a 100-acre plot at Mangalore, a Rs. 15 crore yard on a 150-acre plot at Mysore and a Rs. 10 crore yard on a 400-acre plot at Raichur are also under various stages of implementation, said Mr. D. V. Prasad, director of agricultural marketing and managing director, Karnataka State Agricultural Marketing Board.

The Mangalore yard will be ready by December 31, 1994, while the Raichur and Mysore yards will be ready in April and July 1994 respectively. Mr. Prasad said that yards in the Bombay - Karnataka area were in place long ago. This was not the case in the southern parts of the state.

A novel insurance scheme, introduced by Mr. Prasad, and covering around 16,000 unorganised manual labourers in the yards and around 4000 weighmen (whose wages are less than Rs. 400 a month) is being implemented in association with Oriental Insurance. Under this scheme, the department will pay the premium and the main markets (the yards) will pay the other costs of such things as photographs.

By end January 1994, the total value of transactions in the 78 main yards, 44 sub-yards and 139 rural markets that are developed amounted to Rs. 4000 crore. The number of notified main yards and sub-

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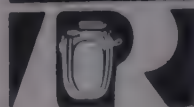


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yards (also known as main markets and sub-markets) and rural markets in the state are 120, 303 and 707 respectively.

However, Mr. Prasad said that the value of trade that has actually taken place would be around Rs. 6500 crore. Traders sometimes showed less than the actual value of transactions in order to avoid paying the market fees. Once traders pay market fees they also come under the sales tax net.

The agricultural marketing department has a cash surplus of around Rs. 75 crore, one of the few departments in the state government to enjoy such a financial position.

A Rs. 50 crore World Bank aid programme is also on offer to the department under the Comprehensive Agriculture Development Programme, but future plans of the department do not entail expenditure of these sums. "We have reached a saturation point," said Mr. Prasad. The World Bank aid is for the development of 33 main markets and 43 sub-markets.

For 1994-95, the department plans to develop at least 10 cattle markets with veterinary facilities and entailing a cost of Rs. five lakh on each.

The department's facilities are used for trade in 150 notified commodities (including coarse grains, oilseeds, cotton, fruits, vegetables, jaggery and plantation crops such as arecanut, cashew, garlic and coconuts). While 123 of the state's 175 taluks are covered by the various markets under the department, geographical reasons do not permit the covering of all taluks, said Mr. Prasad.

The value of turnover on commodities traded through the department's facilities increased from Rs. 2618 crore (1990-91) to Rs. 3200 crore (1991-92) and to Rs. 3300 crore (1992-93). So far, a total of Rs. 67 crore has been spent on developing main markets, Rs. 12 crore on the sub-markets and Rs. one crore on rural markets.

STATES ASKED TO SPEED UP FOOD PROCESSING PROJECTS

State governments will have to help speed up implementation of food processing projects in order to augment the Centre's efforts to attract investments in this priority area, the Minister of State for Food Processing Industries, Mr. Tarun Gogoi, said.

While the Centre had reduced or eliminated excise duty on several food products and brought down the import duty on food processing machineries, the states continued with high taxes on the food processing industry, the Minister pointed out. He was

inaugurating a seminar on "Export dynamism of agro industries" organised to coincide with the fifth annual general meeting of the Confederation of Indian Food Trade and Industry (CIFTI) in Delhi recently.

The Government has set up four expert committees to make recommendations to the Food Processing Ministry to give a new thrust to the industry, Mr. Gogoi said. The committees have been set up for fishing, traditional foods, packaging and export development in north eastern region, he added.

Export of principal agricultural commodities had witnessed a three-fold increase during the last six years from a mere Rs. 1,900 crore in 1985-86 to Rs. 6,195 crore in 1991-92 and accounted for about 14 per cent of total export earnings of Rs. 43,828 crore in 1991-92. In view of the emerging potential for exports in this sector, a target of Rs. 17,700 crore by 2000 AD has been fixed.

In drawing up an export programme, little effort was made to identify the possible implications on environment, especially, soil and water conditions that may follow the kind of production strategies pursued to maximise production of the desirable crop Mr. Gogoi said.

Monoculture plantations which are usually preferred could contribute to acute imbalances in the eco-system, such as deterioration of soil health, multiplication of pests and disease, pollution caused by over use of fertilisers and pesticides and drastic reduction in bio-diversity.

The CIFTI President, Mr. Kulwant Rai, said food processing industry has undergone a revolutionary change and the country was likely to become a major producer of processed food. This sector has attracted investment proposals worth Rs. 33,000 crore and foreign investment of Rs. 1,600 crore.

GOVT. TO BOOST EXPORTS OF WHEAT-BASED ITEMS

The government has assured the food processing industry adequate support to boost the exports of various wheat-based products, including ready-to-cook and ready-to-eat snacks.

The assurance was given by the minister of state for food processing industries, Mr. Tarun Gogoi, while inaugurating a two-day national seminar on "wheat challenges in market economy", in Delhi recently.

In a large wheat growing and wheat

products-consuming country like India, the industry had a major role to play to make available to people the kind of products that were needed in impeccable quality and at reasonable prices, Mr. Gogoi said.

Now that many of the controls had been removed, the industry should develop an appropriate infrastructure to serve the interests of consumers, he said.

New industries using latest technologies would not only provide a higher value addition but would also generate much needed employment, Mr. Gogoi said.

The chairman of the US wheat board of directors, Mr. Stan Timmermann released a book on wheat recipes on the occasion.

The seminar was organised by the Wheat Products Promotion Society, Roller Flour Millers Federation of India and the Society of Indian Bakers and the United States Wheat Association.

MNCS TO ENTER ICE-CREAM MARKET

Multinational ice-cream majors may soon be able to set up shop in India, provided they fulfill an export obligation.

High-level sources in the industry ministry say the government is examining a proposal to allow large companies - both Indian and foreign - enter the Rs. 500 crore ice cream market with their own products.

At present, ice creams can be manufactured only by the small scale sector. Large units can merely package and market the products of SSI units under their own brand names.

However, the government is now considering a proposal to let both Indian and foreign players enter the market without harming the interests of the SSI units.

This can be achieved by imposing export obligation on all large firms entering the sector, sources said. Since India at present does not export ice-creams, due to lack of both sufficient milk surplus and technology, the move is likely to boost earnings in an as yet untapped area, they pointed out. Moreover, the disadvantage regarding foreign branding and marketing can be overcome by asking MNCs to export a part of their output from India, they added.

Sources, however, ruled out any partial opening up of the sector by letting large dairy co-operatives make ice-cream, as had been suggested by the National Dairy Development Board (NDDB).

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COMPANY NEWS

GOA AGRO OILS

Goa Agro Oils Ltd., a new venture in edible oils, which entered the capital market in early 1992, has commenced commercial production of refined rice bran oil. According to company sources, the current production of the plant, located at Kundaim, Goa is about 22 tonnes a day and is expected to reach the full capacity of 50 tonnes a day by the end of the current year.

The company is currently supplying all its products to bulk buyers who repack the same to be distributed to the retailers in Kerala and Tamil Nadu where rice bran oil has ready marketability.

According to the management the delay in its production schedule was due to certain teething troubles in their actual application of molecular distillation process in the refining of crude rice bran oil, which has high content of free fatty acid. The company's technologists have installed a continuous falling-film deodorising process based on a German knowhow.

company, although the product to be manufactured is like ice cream, the difference is in the fat used for manufacture. While most ice creams use milk fat, the products to be manufactured by Brooke Bond will use vegetable fat to ensure rich and uniform texture and taste.

AMUL

A sodding ceremony of Amul's cheese manufacturing plant, largest in India, was performed at Mehemadabad in Kheda district.

The plant with an estimated outlay of Rs. 40 crore, was being built for Amul by NDDB under Operation Flood-Three and is expected to be commissioned in 1995.

The fully-automated plant will have a capacity of handling 6,00,000 litres of milk and manufacturing 20 tonnes of cheese a day, it said. NDDB chairman Dr. V. Kurien

performed the ceremony.

RITESH INDUSTRIES

Ritesh Industries is currently engaged in the manufacture and marketing of readymade garments, especially track suits, jogging suits, T-shirt s, casual wears, knitted fabrics, etc. which are already very well accepted all across the country, under the brand name - Oxford. The company's products have also been very well accepted in the international markets with increasing exports to countries like USA, UK, Germany and Russia.

Under an ambitious diversification programme, the company is now setting up a milk processing plant of 2 lakhs litres per day capacity near Palwal in Faridabad, Haryana. The Rs. 12 crores plant will manufacture processed milk in pouches, skimmed milk powder, whole milk powder, butter, ghee and processed cheese.

BROOKE BOND (INDIA)

A PTI report from Bangalore said that when Sir Michael Perry, chairman of global consumer products giant, Unilever PLC formally inaugurates the new state-of-the art frozen desserts factory, India would join in the select band of developed countries to have such world class manufacturing facilities in food business.

Brooke Bond will be manufacturing in this new unit located in Maharashtra the internationally famous Wall's range of frozen desserts.

For this pioneering venture, Brooke Bond has accessed the latest product development expertise from its anglo-Dutch parent, Unilever, which is the Number One ice cream company in the world (ice cream sales: Rs. 10,000 crores per annum).

The plant is to be located at Sinnar, close to Nasik and a mere 220 kms from Bombay. The plant will have eight million litre capacity.

The Rs. 56 crore frozen dessert manufacturing unit has been entirely met through internal accruals.

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SQUARE D BEVERAGES

The Empowerment Committee has cleared the Madras-based Square D Beverages Ltd's application for an 100 per cent EOU. This is the first 100 per cent EOU for export of alcoholic beverages.

The proposed unit will be the first grain-based distillery in India and alcohol will be produced under technology from Alko Ltd, of Finland.

The company is being set up in the associated sector with 11 per cent equity from TIDCO, an undertaking of the Tamil Nadu government. The location of the project is at Pazhayanoor, Madurantakkam Taluk, Chingleput-MGR District and the work at the project site has already started. The company will also produce protein rich animal feed with technology from Alko Ltd.

The company has a 100 per cent buy-back agreement for its alcoholic products and animal feed from AGIO Countertrade Pte. Ltd., Singapore. The company has already started seed marketing.

The total project cost has been estimated at Rs. 48 crore.

MURLI AGRO PRODUCTS

Murli Agro Products Ltd., is an existing and profit-making company having earned a profit of Rs. 35.23 lakhs for three months working ending March 1993. The company has commenced commercial production of solvent extracted oil and de-oiled cakes in January 1993 and the capacity utilisation for the three months, which is peak season for soyabean, has been 105 per cent.

In the first six months ending September '93, the company expanded its present soyabean processing capacity from 150 tonnes per day to 200 tonnes per day during the lean season when most of the solvent extraction plants are under annual shutdown for preventive maintenance.

The company is now expanding its processing capacity from 150 tonnes per day to 200 tonnes per day of soyabean/rice bran and setting up a continuous oil refinery of 50 tonnes per day (expansion programme implemented).

The company's plant is located at MIDC, Hingna, Nagpur which is not only well connected with rail, road and air to almost all major trade centre with the necessary infrastructure facilities but is also ideal in view of its proximity to the soya cultivating zone in Central India.

VIDIANI AGROTECH

A project to manufacture gluten (concentrated protein) and A-grade starch from wheat

is coming up for the first time in the country near Kosikalan in Uttar Pradesh. At present, starch is produced mainly in the decentralised sector using maize and tapioca as the raw material.

The Rs. 50.45-crore project, appraised by IDBI, is being set up by Vidiani Agrotech Industries Ltd. in technical collaboration with Barr and Murphy Overseas of UK, one of the leaders in wheat extraction technology with over 20 years of experience in wheat extraction process, who have provided technical know-how for setting up 18 wheat processing plants in Austria, Canada, France, Netherlands, Italy and China, of which 16 are in operation and two are under implementation.

IDBI and IRBI have agreed to provide Rs. 10 crore term loan for the project with a production capacity of 6,098 tonnes of wheat gluten, 32,155 tonnes of wheat starch A-grade (international quality level) and 8,151 tonnes of wheat starch B-grade (also known as wheat alcohol) per annum.

The company, promoted by Vidiani Engineers, a turnkey project management company, has already acquired the land and civil construction work is in progress. Delivery of plant and machinery is expected to commence in March 1994 and commercial production is expected to commence in September this year.

Wheat gluten is a natural protein used in advanced countries to fortify the protein level in the flour, bread, biscuit and pasta foods. Because of its adhesive and film forming character, it is also used in meat, fish and poultry products. Wheat starch is mainly used in confectionery and biscuits, pharmaceutical and textile industries. At present the domestic demand for wheat gluten is negligible and is largely met through substitutes.

The company proposes to directly explore the possibilities of selling the product to institutional buyers. It has entered into a sales agreement with Carboeshire of UK for the entire gluten production.

CHARMINAR BREWERIES

The Hyderabad-based Charminar Breweries Ltd., is prepared to make the now famous 'Lal Toofan' beer for Shaw Wallace and Co., which has taken London by storm.

The brewery, at present, supplies its entire beer production to the SWC, which markets it under the 'Hayward' brand.

Mr. K. V. D. Prasad Rao, managing director of CBL, said recently that the company had set up a 75,00,000 bottles per day unit at Sivampet village, in the Medak dis-

trict of A. P., which had already gone into production.

The company had entered into an agreement with Shaw Wallace to sell its entire production for the first two years and 69 per cent, of it for the next three years.

The present production of the company was 36,000 bottles a day, which included strong, mild and draught beer. The company had also a tie-up for the supply of hops from Germany, he said.

KWALITY ICECREAMS

In a bid to combat the problems faced by the company due to inconsistency of milk supply, Calcutta-based Kwaliti Ice Creams (India) Ltd (Kicil) has promoted a new company, Kwaliti Dairy (India) Ltd. (KDIL), to make 20 tpd of ice cream mix powder (ICMP) in equity tie-up with ICICI Ltd.

While ICICI has taken up 10 per cent equity stake in the company, Kicil has taken up 25 per cent stake with the remaining 65 per cent stake being offered to the public through an issue of equity some time in May. The project is being put up at a cost of Rs. 10 crore in Haryana. Moreover, ICICI has already sanctioned a term loan to the company and the other lead manager, Standard Chartered Bank, will be providing a working capital loan.

The world leaders in processed foods engineering, Alfa-Laval, through its parent Tetra-Laval of Sweden, will be providing the technology required to manufacture the product and a custom designed plant by Anhydro of Denmark, another world leader in food technology. The plant is slated to start commercial production by the end of this year.

The company is currently negotiating with Anhydro for exclusive patent rights for the ice cream mix powder.

Initially, though the plant's production will be used for captive consumption, plans are already afoot to sell the product in the domestic market after about two years. By this time, the company would be in a position to market an entire range of cholesterol-free dairy products like ghee, butter, margarine, baby foods and milk powder. This will be possible as the Alfa-Laval process would generate butter fat rather than vegetable fats. Only then will the company go out and market its products on a national basis.

The decision to float a new company and go for backward integration, however, has been driven more by necessity than demand. The irregularity of milk supply and the seasonal nature of the ice-cream industry has forced the company to look out for a sustained supply.

INDIANA DAIRY

Indiana Dairy Specialities, the Bangalore-headquartered unit which manufactures the Dollops brand of ice-cream for the four southern states is due to set up international operations. Joint ventures for production of ice-cream and dairy products are on the anvil, with factories at Nepal and Muscat due to come up shortly, in collaboration with Bakhtapur Dairy Ltd. in Nepal and Zabair Enterprises in Muscat.

According to Mr. T. R. Varadarajan, managing director, these products would be marketed under the Indiana brand name. The move is part of the current thrust at Indiana to increase its range of value added dairy products. Accordingly the company has entered into technical collaboration with the Cottee Corporation of Australia to set up a 100 per cent EoU for the manufacture of food grade cassein, a milk protein with applications in pharmaceutical and food industries.

The unit with a capacity to manufacture 990 tpa of food grade cassein is to come up at Bangalore while the company also plans to relocate and increase capacities of its ice-cream production unit at Bangalore. Manufacturing levels of the other major product sterilized flavoured milk will also be increased at the company's plants at Hyderabad and Nagpur.

In order to fund the various diversification and expansion programmes, the company is to enter the capital market.

RAVILEELA DAIRY PRODUCTS

RDPL's liquid milk plant is situated at Sampanabolu village, Shameerpet Mandal, Ranga Reddy Dist., 30 kms from Hyderabad. The plant with a capacity of 10,000 litres per day (established at a cost of Rs. 114 lakhs) is already into production and is operating at 120 per cent capacity. Plans are underway to expand the plant's capacity from 10,000 LPD to 74,500 LPD in the next 3 months. RDPL is also setting up chilling centre at Karimnagar with a capacity of 40,000 LPD to support the main dairy at Shameerpet for uninterrupted supply of milk.

The management of the company vests in the hands of an eminent Board of Directors. Mr. J. Madan Mohan Reddy, Managing Director, is incharge of the day-to-day operations. He is assisted by Mrs. L. Saranya Reddy, Executive Director who is a CPA from USA. Dr. A. Sanjeeva Reddy, former Managing Director of A. P. Dairy Development Corporation is presently associated with the project as Technical Director. Mr. V. Purnachandra Rao who has had 14 years experience in the Dairy field, is also associ-

ated with the company as Director- Finance. Mr. K. S. K. Prasad is associated with the company as a consultant to monitor the design and commissioning of the plant and machinery, and to oversee the quality of the final product.

RDPL has procured a major part of the Plant and Machinery from Filtron Engineering Pvt. Ltd., Pune, at a cost of Rs. 70 lakhs for its first phase of 10,000 LPD. As part of its expansion programme the company proposes to purchase plant and machinery from Filtron Engineering Pvt. Ltd., Pune and Alfa Laval, Pune, at a cost of Rs. 428 lakhs.

The main products of Ravileela Dairy is liquid pasteurised milk. Ravileela milk is already being marketed through various outlets in the twin cities under the brand name 'Ravila'. The company also manufactures whole milk, toned milk and double toned milk which is sold in 200, 500 and 1000 ml sachets. The company also proposes to manufacture cheese (processed cheese) butter, condensed milk and milk powder. Mozzarella cheese (specially used in pizzas), which has a high demand, will also be manufactured.

D. R. INDUSTRIES

D. R. Industries Ltd., engaged in the field of texturising of Partially Oriented Yarn is embarking on an expansion - cum - diversification project. Expansion is planned in the Yarn Processing Unit and the diversification is to set up a 100 per cent EOU project for freeze dried fruits and vegetables with a capacity of 112.50 tonnes per annum. The total cost of the project is Rs. 21.20 crores.

The freeze drying plant is a 100 per cent EOU with a buyback arrangement from FGS Mills, U. K. The freeze drying plant will process bananas and beans, initially.

TRANSGLOBE FOODS

Transglobe Foods Limited will introduce the 'Farm Fresh' range of Mango, pulp, tomato ketchups, jams, fruit juices, tomato purces and pickles. The brand 'Farm Fresh' has been well entrenched in Gujarat. For further establishing 'Farm Fresh' products, the company proposes to launch a product campaign with an estimated outlay of Rs. 70 lakhs. This would be supported by the regular media support in the form of newspapers, T. V. and other advertisements.

The company's marketing strategy would be to place itself at the market level wherein large players would have difficulty in entering due to sheer smallness of the size of the market. For example, marketing to the large caterers, rural market, bulk consumers like

hotels and restaurants.

The strategy would be to create brand acceptability backed by quality of the product, products differentials by taste, and packing so as to encourage the bulk consumers to go in for the company's product.

HIMALAYA CEMENT

Himalaya Cement & Calcium Carbonate Ltd. with its registered office in Delhi is presently engaged in the manufacture of activated Calcium Carbonate (Installed capacity 5000 MT p.a.) at Sirmaur (HP). It now proposes to diversify its activities by setting up a new division for cultivation & processing of IQF (Individual Quick Freezing) Button Mushrooms (1500 MT p.a.) IQF vegetables (2100 MT p.a.) IQF fruits (300 MT p.a.) and Ginger (300 MT p.a.) at Paonta Sahib Dist SIRMUR (HP). The project has been appraised by IDBI and term loan has been sanctioned by them. Govt of India & HPSIDC are participating in the equity. Company is also proposing to export ready to serve cooked Indian Food.

The Company is promoted by experienced promoters Mr. Man Mohan Malik & Mr. Sanjiv Kakkar. The project is being set up in technical collaboration with renowned American consultants having over 40 years of experience in food processing industry. The major equipment is being imported from USA & Sweden.

Processed Mushrooms, fruits & vegetables hold immense scope in the International Market. Proposed project is being set up as a 100% EOU. The promoters have made firm selling arrangements & have signed "MOU" with leading American & European Companies (having over 60 years of experience) which are involved in marketing of Mushrooms and frozen vegetables.

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INDIAN EXPORT HIGHLIGHTS

SPICES

Export of spices from April to December 1993, have shown significant achievement by registering an increase of about 44 per cent in quantity terms and 38 per cent in value (rupee) terms as compared to the same period of the previous year.

In dollar terms the value of exports shows an increase of about 25 per cent.

The total export of spices from India during April-December 1993 has been 125457 metric tonnes valued at Rs. 393.19 crore (\$ 125.24 million) as against 87127 metric tonnes valued Rs. 285.79 crore (\$ 100.15 million) in the same period of the previous year.

This shows that exports during April-December 1993 has surpassed even the all-time-high in total export of spice from India (Rs. 387 cores in 1992-93).

The export of pepper has shown a spectacular growth by registering an increase of 165 per cent in quantity and 199 per cent in value as compared to last year.

Pepper exports to U. S. has been about

16200 metric tonnes, valued Rs. 59 crores, compared to 6265 metric tonnes, valued Rs. 20 crores, during the same period the previous year.

The export of cardamom (small) has increased by 75 per cent in quantity and 151 per cent in value as compared to the previous year.

GROUNDNUTS

Exports of HPS (hand picked selected) groundnuts crossed one lakh tonne-mark during the current year so far.

Prospects for a further boost to the exports appear bright considering the encouraging response received by trade delegations to their recent visit to the Far East and South East Asia (Australia and New Zealand).

As an export promotion measure the Indian Oil & Produce Exporters Association (IOPEA) had sent delegations to these markets in November/December last and called upon the exporters to give utmost impor-

tance to quality upgradation.

This suggestion was born out of close interaction with overseas buyers and also after watching the trends in the highly competitive international market, says IOPEA chairman, Mr. Nutan Tanna.

WALNUTS

Jammu and Kashmir annually sends out 32,000 metric tonnes of walnuts and its kernels worth Rs. 109 crores to different parts within the country as well as to other countries.

Foreign exchange worth Rs. 19 crore was annually being fetched by exporting 6,000 metric tonnes of walnuts and 4,000 metric tonnes of its kernels to about 22 countries, the agriculture production commissioner, J. and K. government, Mr. Vijay Bakaya said.

He said the production of walnuts and almonds was around 44,000 metric tonnes per annum of which walnuts accounted for 40,000 tonnes.

BEVERAGE & FOOD WORLD

invites technical articles / papers on research and processes relating to Indian Processed Food and Beverage Industry. They should not exceed **2500 words** in length and may be illustrated. Manuscripts for publication should be neatly typed with double spacing on A4 size paper and sent in duplicate. The data must be original, clear, and without repetition. Papers essentially of an advertising nature will not be accepted. Graphs and line drawings should be on **tracing paper**, preferably four to a page if more than one. A covering letter certifying the authorship should also accompany the article.

A complimentary copy of the issue in which the article / paper appears will be posted to the authors. One off-print of the published paper can be provided free to first author, on request. Additional off-prints can be ordered, on payment only.

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Gunter Znamenany, GZ Vertrieb Rhein/
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of General Merchandise especially Coffee
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Hashemi Persian Gulf Int'l Trading Co.,
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51347. Fax: 041-31683. Importers of sugar,
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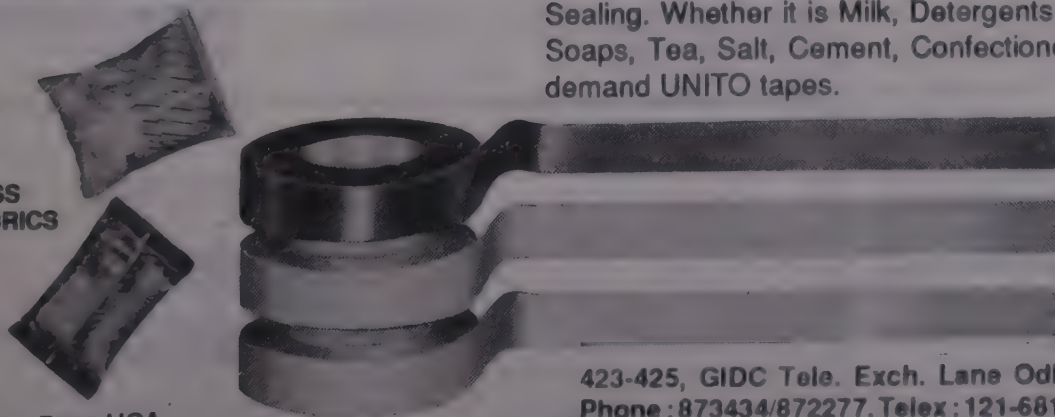
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TRADE FAIRS & EXHIBITIONS

FOOD INGREDIENTS JAPAN

Venue: Tokyo

Date: 19-21 April 1994

The first Food Ingredients (FI) Japan exhibition to be held in 1994 has been completely booked out within months of its launch in April 1993. An offshoot of the highly acclaimed FI series in Europe and Asia, FI Japan is organised by Expoconsult on request of FI exhibitors looking to penetrate the huge Japanese food market. This exhibition will be held at Harumi Fair ground, Tokyo. As of now, the waiting list already exceeds 20 potential exhibitors.

FI Japan will showcase the latest food ingredients, flavourings, colourings, preserving devices and laboratory equipment. The exhibition will also increase business opportunities for its visitors and exhibitors alike. With a total area of 4,725 square metres, FI Japan will accommodate a total of 150 exhibitors, including agents and subsidiaries. These include international suppliers and manufacturers of food ingredients, additives and laboratory equipment from more than 20 countries around the world.

FI Japan is sponsored by the Advanced Food Ingredients Council, Japan Flavour & Fragrance Manufacturers' Association, Japanese Association for Tooth Friendly Sweets and Japan Food Additive Association.

The next FI Japan exhibition is scheduled for 24-26 April 1995.

For details, write to: Ogilvy & Mather, Public Relations (S) Pte. Ltd., 1 Maritime Square, No. 11-10 World Trade Centre, Singapore 0409. Tel: 2779-403

MACROPAK '94

Venue: Utrecht, Holland

Date: 2-6 May 1994

Macropak is compact, comprehensive and offers quality. With the organization of an international conference on the 3rd May by the European Research Centre, the initiator of the 'Global Panel', Macropak '94 will no doubt be the place where top executives meet.

Participants will bring a representative range covering the following packaging sectors: Packaging machines and lines; Auxiliary equipment (weighing, dosing, labelling,

bar coding); Bulk Packaging; Packaging and packaging materials, Knowhow and information transfer; Packaging design.

For further information, contact: The Dutch Packaging Centre, Tel: +31 1820 12441 Jaarbeurs Press & Communications Dept. (B. de Jongh) Tel: +31 30 955 504

60TH ASBC ANNUAL MEETING

Venue: Toronto

Date: May 14-18 1994

Technical people involved in the brewing, malting and allied industries will meet at the American Society of Brewing Chemists (ASBC) Annual Meeting to be held in Canada in May.

Exhibitors will present new analytical instruments and techniques used in brewing to approximately 300 ASBC attendees. The ASBC Annual Meeting will also feature a welcome reception, spouse/guest program, president's banquet and golf tournament.

The 60th ASBC Annual Meeting will include the technical program, technical and poster sessions, exhibits and social events.

For details, write to: American Society of Brewing Chemists Inc., 3340 Pilot Knob Road, St. Paul, MN 55121-2097, U. S. A. Tel: 612/454-7350 Fax: 612/454-0766

CANNEX 'ASIA' 94

Venue: Bangkok

Date: May 18-21 1994

This is the Asian International Can making and Canning Exhibition covering all aspects of canning.

For details, write to: Richard Hodgson, Overseas Exhibition Services Ltd., 11 Manchester Square, London W1M 5AB, U. K. Tel: 44(0) 71486 1951

PAPRO'94

Venue: Dusseldorf, Germany

Date: May 25-31, 1994

The international fair for package production, paper, film and foil manufacturing and converting, "PaPro' 9" will be held for the third time in May this year. Once again manufacturers of machinery, materials and processed for package production will confront the challenge of international competition.

Range of exhibits: Machinery and equipment for various area of application in paper, card and cardboard processing, Package design-graphic art and construction; Auxiliary machinery and equipment, rollers and tools, Inspection, supervision and control equipment for production processes; Quality control units and equipment; Equipment for storage and transport; Materials; Auxiliary materials.

PRINTING & PACKAGING '94

Venue: Kuala Lumpur

Date: June 8-10 1994

This is the 6th Malaysian International Printing & Packing Equipment & Materials Exhibition.

For details, write to: Richard Hodgson, Overseas Exhibition Services Ltd., 11 Manchester Square, London W1M 5AB UK Tel: +44(0) 71 486 1951 Fax: +44(0) 71 413 8230

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BOOK REVIEWS

Mycotoxins in Grain : Compounds other than Aflatoxin. Edited by J. David Miller and Locksley Trenholm. Published by Eagan Press, Mn., USA. Hardcover. Pgs : 552 Price :\$ 134.

This may be the first book on mycotoxins not dealing with the most notorious of mycotoxins, aflatoxin. Though continued economic importance and health significance of aflatoxins is recognized, after four decades of extensive research, our knowledge of aflatoxin has become so immense that many good treatments on various aspects of aflatoxins are already available.

At the Eighth International Union of Pure and Applied Chemistry (IUPAC) Symposium on Mycotoxins and Phycotoxins in Mexico, November 1992, Pieter Stein, President of the Applied Chemistry Division of IUPAC used the term "fumonisin generation" of mycotoxin researchers. His statement reflects the substantial shift of research effort from aflatoxins to other agriculturally important mycotoxins produced by several genera of fungi. These toxic metabolites include the trichothecenes deoxynivalenol and nivalenol, zearalenone, and fumonisins from various *Fusarium* species that occur worldwide. *Ochratoxin* from *Aspergillus ochroceus* and *Penicillium verrucosum* is a problem in western Europe, but it can occur elsewhere including North America. Several toxins from *Alternaria* species appear to be important in certain geographical areas.

This is a reference text on the chemistry and biology of mycotoxins other than aflatoxin, with emphasis on those that affect food safety and animal health and productivity. The chapter on the chemistry of mycotoxins outlines the molecular structures and spectroscopic data where appropriate. Mass spectroscopy and nuclear magnetic resonance spectroscopy data acquired on modern instruments are included for those *Fusarium* metabolites discovered during the past decade. Since *Fusarium* species are primarily plant pathogens, the text highlights plant pathology and plant breeding for fungal resistance in affected crops. The species of *Aspergillus* (other than *A. flavus* or *A. parasiticus*) and *Penicillium* that produce important storage mycotoxins are discussed in terms of their ecology and physiology. In contrast, toxigenic *Alternaria* spe-

cies are largely saprophytic on senescent cereal tissue.

Mycotoxin-contaminated grain is associated with food safety issues and the health and productivity of farm animals. In this book, several perspectives are included: overall toxicology; immunotoxicology; and the important new area of study, the interactive effects of mixtures of mycotoxins. An appraisal of decontamination technology is also provided.

Finally, the consequences of mycotoxin-contaminated grain for humans are considered: strategies used in risk assessments for mycotoxins in food, mycotoxin residues in animal products used for human food, and the economic impact of mycotoxins on agriculture and food production. After almost 30 years, the human carcinogenicity of aflatoxin has been established (International Agency for Research on Cancer Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans no. 56. 1993. IARC, Geneva). The role of the other mycotoxins in human disease has not been firmly elucidated. A surprising number of human diseases have been blamed on mycotoxins in food. These are reviewed. As was the case for aflatoxin, the importance of fungal metabolites, such as fumonisin, deoxynivalenol and/or nivalenol, and ochratoxin will require much more study before their impact on human health is fully known.

Principles of Cereal Science and Technology 2nd Ed. edited by R. Carl Hosency. Published by AACC, Mn., USA. 374 Pages, hardcover. Price US \$ 95.

The field of cereal science and technology is very broad and complicated. Cereals are complex biochemical entities that vary in composition and properties from year to year, from location to location, and from one cultivar to another. Cereal science is also complicated by the fact that the same raw material may be used to make different products. Therefore, the definition of "good quality" for a cereal such as wheat changes depending upon whether the wheat is used to make a loaf of bread or a cookie.

To understand cereals and their processing into products, the cereal scientist must be a jack-of-all-trades. He or she must

understand chemistry (all areas), biochemistry, physics, engineering, and many other sciences. In addition, the scientist must also understand the "art" of the cookie baker and the brewmaster. Clearly, no one will accomplish all of these. Those of us who have been in the field have long since reconciled ourselves to the fact that we cannot understand it all but forget how difficult this is for the new, idealistic student to accept. The purpose of this book is to provide such students with a basic background to stand on as they start their studies of how cereals work. In an attempt to accomplish that goal, the book is written as a text, not simply as a reference book.

Concentrated and Dried Dairy Products by Caric, M. Publishers: VCH, Pappelallee 3, D-69469, Weinheim, FDR. Pgs : 249. Hardcover. Price : DM 179.00 (£ 74.00)

The first book of its kind in nearly two decades, 'Concentrated and Dried Dairy Products' presents a comprehensive overview/review of the very latest technology and techniques used in the manufacture of concentrated and dried dairy products. Emphasizing state-of-the-art technologies for the manufacture of all concentrated and dried dairy product groups, coverage identifies each group's theoretical background and basic principles, examines the relationship between technology and product quality, and discusses new developments in equipment. Step-by-step processes, operational details, quality control and other manufacturing practices are supplemented with information drawn from scientific literature, patents, and materials obtained from commercial producers of large-scale equipment.

In addition to traditional products (sweetened condensed milk, milk powder), the author examines the technologies behind special products such as whey protein products, casein, recombined milk, infant formulas and many others. Numerous schemes, flow-charts and process diagrams are employed to foster a thorough understanding of the technologies.

A must for food and dairy scientists, technologists and engineers, as well as professionals in food related industry.

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- Section 4** Indian Exporters of Processed Foods, Beverages, Ingredients, Additives, etc.
- Section 5** Foreign Importers of Processed Foods, Beverages, Ingredients, Equipment, etc.
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Post publication price : Rs. 400/- (packing & postage included)
 Foreign : US \$ 50 by airmail
Date of Publication : July 1994

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 105 Heera Panna Ind. Estate, Goregaon (E), Bombay 400 063.
 Tel : 8886309, 8899113, 8401769 (R)
 Fax : (9122) 88227577, 8725164.
 Gram : MIXIN Bombay 400 063.
 Branch : 36, Kohinoor Indl. Estate, Bombay 400 063.
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Branch : 36, Kohinoor Indl. Estate, Bombay 400 063.
Exec : * Dr. V. V. Chavan * D. C. Pavaskar * S. V. Chavan
*** Mrs. M. V. Chavan**
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● Paste/Powder Mixer/Driers ● Portable Dispenser
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MIXERS
 Mamko Process Equipment Manufacturers

The Company is also listed
In Alphabetical order of Products

AGITATORS
 Mamko Process Equipment Manufacturers
MIXERS
 Mamko Process Equipment Manufacturers

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(Please specify)

(PLEASE TYPE OR PRINT)

NAME OF UNIT _____ ESTD. _____

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BRANCH OFFICES :

- 1) _____
- 2) _____
- 3) _____
- 4) _____

EXECUTIVES (with Designations)

- 1) _____
- 2) _____
- 3) _____
- 4) _____

PRODUCTS MANUFACTURED/TRADED :

Financial Year : _____

INSTALLED CAPACITY :
(Itemwise in tonnes)

PRODUCTION :
(Itemwise in tonnes)

EXPORTS (Value in Rs. lakhs) : _____

MEMBERSHIP OF ASSOCIATIONS : _____

AWARDS RECEIVED : _____

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Name of Person Signing

Pin Code

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(Please type or print)



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Yours faithfully

Name of Firm :

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Address :

Name of Person Signing

Pin Code

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(Please type or print)

PRODUCT REVIEWS

SHRINK WRAPPING MACHINE

Shrink Wrapping process involves the use off a heat shrinkable plastic film which is wrapped around an individual or group of products. The product wrapped with the film is then passed through the Shrink Wrapping machine wherein the film shrinks in area and takes the shape of the enclosed product forming a tight, compact, neat pack. Shrink wrapping is versatile enough to pack any product of any size and shape. A product as small as a pin and as big as a truck can be shrink wrapped.

The basic advantages derived from Shrink wrapping is that it is economical, involves reduction in operation time and labour, is pilfer proof packing, affords protection from weather, and gives enhanced sales appeal. It finds application for pesticides, pharmaceuticals, food products, consumer products, among others.

Aarkay manufactures a wide range of Shrink wrapping machines like Shrink chambers, Shrink tunnels, L-sealer tunnels, Web sealer tunnel, to cater to your packaging requirement, making it a simple reality.



For details write to:

Aarkay Industries,
1, Hormuzd
131, August Kranti Marg,
Bombay 400 036.
Tel : 3670537, 3675277
Gram : CRAFTWORLD.

HUMIDIFIERS / DISINFECTORS

Yashasvi humidifiers are regularly bought by Sericulture Dept's, CPRI, Labs, Agriculture Research Stations & Colleges, Mushroom and Poultry Farms, Forest Labs/Silviculturists/Nurseries, Tanneries, Coffee/ Tea Curing Centers etc.

'Unikair' Aerosol Humidifier come with Valve and Tri-wheel, Handle,

etc.

Aerosol Disinfector is a must for food processing units !

Unique Features : ★ Fully Non-Corrosive Stainless Steel Equipment; ★ With Built-in Timer; ★ Soluble Disinfectants (Formalin, Aldekol H etc.) is converted into aerosol micron particles for effective Fumigation; ★ Multi Purpose utility for Fumigation and also to control Humidity.

For details write to:

Mr. R. Sukumar
Yashasvi Aerosol Equipments Pvt. Ltd.
G - 23, A. S. Char Street,
Bangalore - 560 053
Tel. : 322025 - 76112
Fax : 080-358434

U. V. WATER PURIFIERS

Alfa Purifiers and Appliances Pvt. Ltd. manufacture a complete range of Water Purification systems based on the latest international Ultra Violet technology. These purifiers are capable of delivering 100% safe drinking water as per W. H. O. Standards. The company has various models which range from 100 lts/hr. to 1,00,000 lts/hr. output capacity.

Unique Features : Alfa Water Purifiers are made from 30.4 Grade stainless steel for long life and durability; in corporate the Quartz Glass technology for maximum U. V. transmission; have a unique wiper assembly system for self service and easy maintenance; and use heavy duty slim line American UV lamps.

All Systems are backed by a one year warranty. Reputed Customers include the Taj Group, Oberoi, Ramada, Leela, Windsor Manor, besides thousands of smaller hotels, restaurants, canteens, etc.

For more details, Contact :

Alfa Purifiers and Appliances Ltd.
222 Shah & Nagar (A2)
Lower Parel
Bombay 400 013.
Tel: 494 5957/ 494 4942

SIZE REDUCTION EQUIPMENT

Gadekar & Associates Pvt. Ltd. are the exclusive distributors for URSCHEL Laboratories' designed and manufactured precision Size Reduction Equipment in India, Pakistan, Sri Lanka, Bangladesh and Nepal. This equipment finds application in food processing, chemical and pharmaceutical industries.

Urschel manufactures over 40 different machines for the high speed cutting of fresh food products - slicing, dicing, strip cutting, shredding, granulating, comminuting, homogenizing, emulsifying, mincing - and many other food cutting application. Several manufacturers of food products like mango pickles, potato chips, tutti fruiti, guava pulp etc.,

in India, Pakistan and Sri Lanka are current users of Urschel machinery.

For more details write to:

Gadekar & Associates Pvt. Ltd.

859 Sector 15 A,

Faridabad - 121 002.

Tel/Fax : 91-11-8282040, 91-11-8291344

SANDWICH PANELS

Metacolor Precoated Steel Sandwich Panels with Polyurethane filling are widely used in the fabrication of cold rooms, walk-in coolers, ripening rooms and process control rooms as well as in the refrigeration field, food processing and other industries for storage of fish, meat, fruits and vegetables, vital drugs, yarn, light sensitive colour film and pharmaceuticals. Sandwich Panels with a trapezoidal outer skin and plain inner skin can be used to obviate the need for false ceilings and undertake insulation in large textile storage sheds while ensuring tremendous structural strength and low thermal conductivity.

For more information contact

Shree Precoated Steels Ltd.

Hanuman Building,

308, Perin Nariman Street,

Fort, Bombay 400 001.

Tel : 266 254, 266 1232, 2661141

Fax : 91-(22)-2661878

Telex : 011-82793 YOGI IN.

BAKERY EQUIPMENT

For bakeries, confectioneries and hotels, C. I. M. Int., Italy, offers dough sheeting and laminating machines with flour dusting from simple to automated models for the production of puff pastry varieties, croissants, short crust.

Also from the same company are make-up plants from minilines to automated lines with dough sheeting, gauging, cutting, guillotine, centre filling depositor etc., and croissant moulders from 800 pcs/hr.

For details, write to:

Tricon Co.

5 A, Mayur,

771 Deccan Gymkhana,

Pune - 411 004

Tel: (0212) 342203 / 344607

Fax: (0212) 342451

FLOWMETER

Difficult Liquid Flow Measurements previously impractical, are now simple and routine. Basically, if it flows in a pipe (pipe size Min. 25 mm upto 1500 mm dia), it most likely can be measured by the Model M3-902 Flowmeter available from Material Control, Inc. USA.

Due to the principle of operation, the transducer can be mounted externally to the pipe, or conduit, which is its major advantage. Thus obtaining flow reading without process interruptions, and with a device that requires no maintenance or periodic cleaning. Since there is no liquid contact, there is no concern for clogging, material buildup, corrosion, abrasion or coatings. It is an ideal Instrument for Flow Measurement Surveys.

A partial list of successful installations include : Pump Testing,

Liquid Sugar, Well Water, Sewage, Milk, Caustics, Effluent, Citrus Juice, Acids, Paper & Pulp, Lube Oil, Flow Surveys, Fuel Oil, Service Water, Pump Protection, Drinking Water, Potable Water.

For further informations, please contact:

CDCON

International Agency Division

B-1, Shantivilla Apt.

Pratapgunj Society, Vasna,

Ahmedabad - 380 007.

Tel : 0272-430709 / 432397

Fax : 0272-432397

SPRAY GUNS

Thermax Surface Coatings Ltd. manufactures high quality air spray guns. The TGA-503 spray gun is suitable for suction/pressure feed application and the TFG-513 is used with gravity cup. Both the spray guns give a super finish to the products which is comparable to international standards.

The gun body is manufactured from forged aluminium as against the commonly available cast gun bodies. The forged body gives a much longer service life. Other features of the guns are:

- Superior quality of air caps/fluid tips.
- Stainless steel, hardened fluid needle giving a longer and leak free performance even with abrasive and corrosive spraying materials.
- Wider choice of nozzle/air cap combinations.
- Stainless steel or M. S. hardened fluid tips for any type of applications including pharma industry.
- PTFE gaskets for longer and leakproof operation.
- No threading on gun body - a replacable baffle is used to avoid the recurring problem of threading wear out.
- Special air caps available for superior auto quality finish with wider spray width pattern.
- Lesser maintenance, larger service life and easy availability of spares with local dealers.



Variations of the TGA gun are available for specific spray application like ceramic glaze spraying, film/sugar coating on tablets, food grade material spraying. An extension nozzle can also be used

with gun. The extension nozzle has circumferential spray pattern and is ideal for painting insides of tubular objects and other inaccessible parts.

For further details contact:

Thermax Surface Coatings Limited
Plot No. 7, D-1 Block
MIDC Indl. Area, Chinchwad,
Pune - 411 019.
Tel: 770436, 774936
Fax: 0212-770394
Tlx: 0146422 & 0146302

PAPER / PLASTIC POLY LAMINATES

With experience gained over a decade in the field of packaging and printing the Central India Group decided to manufacture related products in flexible packaging which has caused a revolution the world over in the field of packaging. The factory is located at Patancheru, Medak Dist., A.P. The Company manufactures paper poly laminates, plastic laminates and Aluminum poly laminates with an installed capacity of 560, 720 and 450 tons per annum respectively.

With our new Extrusion Lamination plant and six colour printing we would be able to meet requirements for Glassine poly with printing upto six colours. The quality is good as the plant is the latest with full electronic controls, corona treatment etc. The adhesive lamination plant is also functional and we are in a position to give all types of laminates. The company is also finalising contract for supply of eight colour Rotogravure Printing machine from a well known supplier in Europe with automatic controls. Once this machine is commissioned the company would be able to match international standards.

The company is also introducing a special feature for Flexible packaging by introduction of Solventless Lamination. In addition, the company is putting up in house facilities for manufacture of printing inks, a laboratory for Quality Control of raw materials and finished products. At a later stage there are plans to add our own cylinder making unit.

With the above infrastructure the company would be able to supply packaging material for confectionery, soap, detergents and any other areas where moisture barrier properties are required. The plastic laminates are finding extensive and ready use in packaging ready-to-eat foods, snacks, biscuits, shampoos, supari, oil etc.

For more details, write to:

Ankit Packaging Ltd.
H.O. 3-6-140, Liberty Road,
Himayatnagar,
Hyderabad 29.
Tel: 236645, 230045
Telex: 425-2257 CPPL IN
Fax: 0842-233345

HIGH PRESSURE HOMOGENISER

Mamko offers a range of high pressure homogenisers. Here, as against the shear in the usual cases pressure is used for homogenisation. The pressure generates high level of turbulence which gives homogenisation scale to a degree of fineness equivalent to the size of turbulent eddies. The homogeniser is available in various capacities from 100 to 5,000 LPH and pressure range of 50 to 300 bar. Another variant here is the length or the time over which the turbulence is spread. The choice is again made depending upon the fineness required

and temperature and turbulence sensitivity of the material. The long residence type is manufactured inhouse and short residence type (also known as Gaulin type) is manufactured by the company's principal, Pasteur Engineering Company (P) Ltd., Calcutta.

For more details write to:

Mamko Process Equipment Manufacturers
(A Division of Innovative Laboratory and Workshop Pvt. Ltd.)
105, Heera Panna Industrial Estate,
Goregaon (East), Bombay 400 063.
Tel: 8756309, 8749113, 8401769
Fax: (9122) 8822757, 8725164
Gram: MIXIN Bombay 400 063.

PET BOTTLES / CONTAINERS

Jauss Polymers Ltd., a profit making company, has been promoted by Mr. Dildeep Singh Sethi, Mr. Daljit Singh Chandhok and Mr. Harpreet Singh Sethi. The unit has been financed by IDBI, IFCI, ICICI, and state level institutions. The company manufactures jars, bottles and containers made of polyethylene terephthalate (PET). The company is having two units, one at Kurali (Punjab) and another at Surajpur (U.P.). The main plants have been imported from Nissai ASB, Japan. Both the units together have the largest installed capacity in Northern India i.e. 13.8 million bottles per annum. The first unit started its commercial production in mid 1989 and the second unit started its commercial production in May '92. The company is further expanding its installed capacity to 19 million bottles per annum by putting up a third plant, to be imported, from Japan. At the same time the company is also putting up a plant for backward integration. With the expansion cum backward integration, the company would be able to achieve a turnover of about Rs. 18 crores in 1993-94.

For more details write to:

Jauss Polymers Ltd.,
47, Hanuman Rd.,
New Delhi 110 001.
Tel.: 312480 Fax: (011) 352471
Tlx: 3166347 WLD IN

MATERIAL HANDLING SYSTEMS

The Company offers material handling systems with powered & non-powered equipments on Turn-Key basis such as suspension conveyor, gravity roller conveyor, drum jockey, Stacker, slat conveyor.

Pallet Handling Systems, Belt/Chain/Stats/Slats/Screw/Flight Conveying Systems, Drum Handling Systems, Bucket Elevators, Document Conveyors; etc. - whatever your requirements, consult, Mac Industrial Systems.

For more details, contact:

Mac Industrial Systems,
C/80, Snehdhara Society,
Dada Bhai X Road No. 3,
Vile Parle (W),
Bombay - 400 056.
Tel: 8324244

MASALA PASTE

Lenco-Chem Laboratories Pvt. Ltd. (Foods Division) offers 'QUEENS' brand of pre-prepared masala paste in a unique blend of

choice spices for instant cooking. The products are hygienically manufactured at Goa, India.

The product mix in 150 Gms. pouches includes Red Vindaloo Meat Paste, Green Chillie Meat Paste, Stuff-N-Fry Fish Red Paste, Green Fish Paste, Garlic - Ginger Paste and Chillie-Garlic-Ginger Paste.

For more details, contact:

M/s. Lenco-Chem Laboratories Pvt. Ltd. (Foods Division)
12/A, Diamond Centre, L. B. S. Road,
Vikhroli (W), Bombay - 400083.
Tel : 578 3425 Fax : 91-22-5783425

ULTRAVIOLET SYSTEMS

Recent study has proved that 316 stainless steel can leach oxides into ultra pure water. Hitech Ultra Violet systems eliminate oxides and other contaminants in ultra pure water by using only Teflon and PVC as parts which contact water. The excellent ultra violet transmission characteristics of Teflon contains a higher ultra violet field which results in a better kill of micro-organisms.

A special water flow pattern through the Teflon tube assures turbulence and full exposure to the ultra violet rays. High turbulence and non wetting characteristics of Teflon eliminate any build-up of contaminants that could block ultra violet rays. Hence no wiper or chemical additives systems are necessary. Separation of fluid circuitry from electrical circuitry allows the lamps to operate continuously even without water. This also allows the ultra violet lamps to operate at their optimum operating temperature so they can produce optimum ultra violet light.

Hitech Ultraviolet also manufacture TOC (Total Organic Carbon) reduction sterilizers which oxidise organics into carbon di-oxide gas.

Application : Aquaculture, Beverage Industries, Breweries, Dairies, Water Bottlers, R.O. Systems, Wash Water for Food products such as vegetable, fruit, fish etc. Toxic Chemical Distribution, etc. Pharmaceuticals and Cosmetic Industries, Hospitals, Laboratories, etc.

Hitech Ultraviolet manufactures sterilisers in various capacities depending on the flow rates required by each application and a maximum capacity of 12 lac L.P.H.

For more details, write to :

Hitech Ultraviolet,
C/14 Grace Plaza, S.V.Road,
Jogeshwari (West),
Bombay 400 102
Tel : 6286845, 6282517
Fax : 6206702 Tlx : 117 8471.

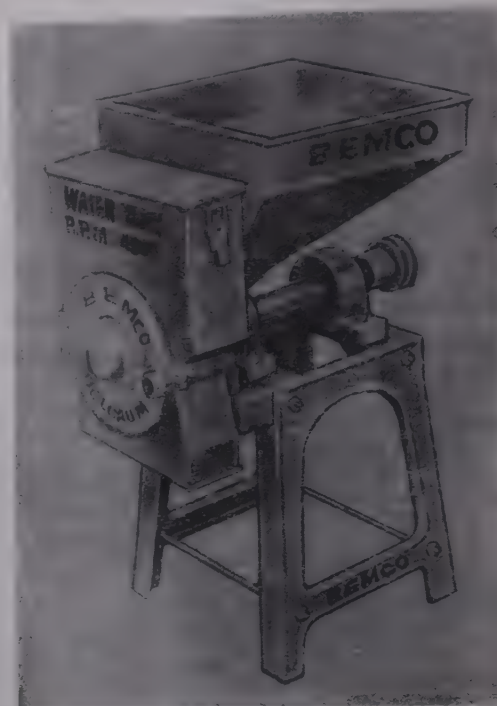
FLOUR MILLS

'Bemco' are leading manufacturers of flour mills and emery stones for the last three decades. These are manufactured out of best raw materials available and under the supervision of highly qualified and experienced persons to maintain quality and durability.

Emery stones are manufactured from high grade synthetic emery. Flour mill are available in 12", 17" and 20" in vertical type and 18" in horizontal type. These are designed in such a way that there should be minimum maintenance cost and maximum output. Bemco flour mills and emery stones are popular not only in India but also Abroad. These are exported regularly to African countries.

Because of suggestions given by valuable clients Bemco have added

to their range of production 8" and 10" domestic flour mills which run on 1 and 1.5 HP motor respectively on single phase. Also Bemco have developed and supplied pulverisers which are suitable for grinding spices, chemicals, chillies etc.



M/s. Bemco Agro Implement Pvt. Ltd.
Regd. Office & Works :
P.O. Udyamabag,
Belguam - 590 008.
Tel : 30388 Grams : BEMCO AGRO
Telex : 0863-287
Fax No. 0831-21284-BEJU-IN

LUG CAP SEALING MACHINES

Introducing for first time, Twist-Off Lug Cap Sealing Machine to give 100% leak proof air tight seal for 53 mm & 63 mm Lug Caps. Thorough R & D has evolved innovative machines which are successfully packing over one million bottles without maintenance.

Semi Automatic and Automatic machines have capacity of 1200 & 2200 bottles/hr respectively. Innovative design ensures smooth working and eliminate holding of glass bottles while capping operation. Only effortless manual bottles movement is required which eliminates need of skilled worker. Standard machines are designed to work for any bottle height from 9 cm to 15 cm.

For more details, write to,

M/s. Raj Products & Equipments,
P.O. Box 8075,
Bombay 400 056. INDIA.
Tel : 8192250 / 8192750
Fax : 91-22-8192750 / 8375628.

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BUYERS' GUIDE

TO SUPPLIES & SERVICES FOR FOOD / BEVERAGE INDUSTRIES

ACETIC ACID

Balaji Dye Chem, — See under "Acids"

Olin Chemicals, A-303 Padmavati Nagar, Gen. Arunkumar Vaidya Marg, Goregaon (E), Bombay 400 063. Tel : 8406988 Fax : 8734332

ACIDS

Ascorbic, Citric, Maleic, Benzoic, Fumaric, Muriatic, Phosphoric, Tartaric, Gibberellic, Tannic USP & Tech. etc.

B. I. Mehta, 2-B, Ganga Vihar, 94, Kazi Sayed St., Bombay 400 003. Tel: Off : 344 5506 / 344 7879 Res: 644 2063 Tlx : C/o. 11-75617 MNCB IN Attn: B. I. Mehta. Fax : 00-91-22-8552708.

Balaji Dye Chem, 5, Prafulla Bhavan, 130, Khareghat Rd., Dadar, Bombay 400 014. Tel : 5610530/5611117/5321303 (R). Gram : BALAJI CHEM. Bombay 400 080.

Citurgia Biochemicals Ltd., Neville House, J.N. Heredia Marg, Ballard Estate, Bombay 400 038. Tel: 2618071. Gram: CITURGIA, Bombay. Tlx : 11-86472 BOM IN

Sesu Trading Corporation, 4th Flr., Sai Chambers, 367/369, Narsi Natha St., Bombay 400 009. Tel: 3420832/3426402. Telex : 11-72247 Fax: 11-3420832.

Thirumalai Chemicals Limited, Maalavika Centre, 5th Floor, 144, Kodambakkam High Road, Madras 600 034. Tel: 8255755 Tlx: 041-5415 TCL IN.

ADDITIVES, FOOD & BEVERAGE

B.I. Mehta—See under "Acids".

Burzin & Leons Agenturen Pvt. Ltd., Readymoney Bldg. No. 1, Sir Ratan Tata Marg, Tardeo Rd., Bombay - 400 034. Tel : 4944616, 4921255. Tele/Fax : 4930283

Ganesh Dehydrate Ltd., Marketing Div., 191-H Dr. Viegas St., 9th Cavel Cross Lane, Kalbadevi, Bombay 400002. Tel : 2088897/

298476/2068335 Gram: BENZ ACID. Fax: 022-2068475

Olin Chemicals -- See under "Acetic Acid".

Sesu Trading Corporation, — See under "Acids".

Thirumalai Chemicals Limited — See under "Acids".

Vin Flavours 'Viniketan' 1, Krishna Society, Hari Bhakti Extn., Old Padra Rd., Baroda 390 015. Tel: 541196/322048. Gram: VIN-FLA.

ADHESIVES / ADHESIVES TAPES

Liston Laghu Udyog—See under "Pickle Cutting & Slicing Machine".

Polypak Products, 71/C Sundar, N. G. Acharya Marg, Chembur, Bombay 400 071. Tel : 5513727/5519736

ADHESIVES, HEAT RESISTANT

Manikant Brothers —See under "Anti-Corrosion Chemicals".

ADHESIVE TAPES, PTFE, GLASS

Unnati Corporation, 423-425, GIDC Tele. Exch. Lane, Odhav, Ahmedabad 382 415. Tel: 873434 /872277 Tlx: 121-6816 ANAR IN Fax: 272-366505.

AGAR AGAR (POWDER/STRIPS)

Amit Fine Chem, 14, 3rd Dharia House, Opp. Vinod Silk Milk, Ashok Chakravati Rd., Kandivli (E), Bombay 400101. Tel : 612 7988 / 889 1730.

Parul Enterprises, Dharia House, Top fl., Opp. Vinod Mill, A. C. Road, Kandivli (E), Bombay 400101. Tel : 6127988/8891730

AGITATORS

Cosywo Engineering Co., 15 Laxmi Co-op. Indl. Estate, Near Nagarwal Hanuman Mandir, Amravati Rd., Ahmedabad 380026. Tel : 368168/368000 Gram :

COSYWO

Fabdecon Engineers, 138, Damji Shamji Ind., Complex, Off. Mahakali Caves Rd., Andheri (East), Bombay 400 093. Tel: 8347952/8343179. Grams: VACFILTER, Ghatkopar, Telex: 011-79194 FABD-IN.

Frigmaires Engineers, Janta Ind. Estate, Gala No. 8, Tulsi Pipe Road, Lower Parel, Bombay 400 013. Tel: 4945624/4926159. Tlx: 011-75984 FRIG IN.

Lara Engineers, 19 Arunoday, Alkapuri, Baroda 390005. Tel : 323157/327269.

Mamko Process Equipments—See under "Emulsifiers".

United Technologic, — See under "Conveyors".

AIR BLOWERS

Indcon Polymech Limited, 311, Mansarovar, 90, Nehru Place, New Delhi 110 019. Tel: 6431908/6436869/6438365. Telex: 031-61678 Fax: 11-6464994.

AIRCONDITIONING/ REFRIGERATION PLANT & EQUIPMENT

Advance Equipment Company, Navjivan Society, Building 3/2/7, Bombay Central, Bombay 400 008.

National Refrigeration Works —See under "Refrigeration Equipment"

Refcon Engineers, 4 Little Gift, Plot 641, 19th Road, Khar (W), Bombay 400 052. Tel : 542291

Saffaire India, 51, Juhu Supreme Shopping Centre, Gulmohar Cross Rd No. 8, J.V.P.D. Scheme, Bombay 400 049. Tel. 6203998. Cable : SAFRIGE

Transair, 27/A Laxmi Indl. Estate, Off Linking Rd., Andheri (W), Bombay 400 058. Tel : 6269292/6293514 Fax : 91-22-6269292/91-22-6268844

AIR CURTAINS

Air Frige Industries, 10/66 Kirtinagar Indl. Area, New Delhi 110015. Tel: 531972. Gr.: FRIGDAR.

AIR DRIERS

Catalysts & Chemicals, Shah Indl. Estate, Kherani Rd., Nair Wadi, Behind Church, Sakinaka, Andheri (E), Bombay 400 072. Tel: 5783728/5784081/8361339 Gram.: ADSORBENT.

Delair India Pvt. Ltd., 20 Rajpur Road, Delhi 110 054. Tel: 23 11 29 / 291 84 62.

Indcon Polymech Ltd. — See under "Air Blowers".

Sakav Enterprises, 12/82, Govind Nagar, Sodawala Lane, Borivali (West), Bombay 400 092. Tel: 8010250.

AJINOMOTO

Ace International -- See under "Guar Gum".

Balaji Dye Chem — See under "Acids".

Sesu Trading Corporation — See under "Acids".

ALUMINIUM FOIL

India Foils Limited, 4, Mangoe Lane, Calcutta 700 001.

ANALYSERS

Technovation, 4 Paramel, St. Cyril's Rd., Bandra, Bombay 400 050.

ANTI-CORROSION CHEMICALS

Manikant Brothers, 311, New Anant Bhuvan, 257/65 Narsi Natha St, Bombay 400 009. Tel: 375 2881 /375 6977. Telex: Care-011-74491 TEXOIN. Fax: Care 91-22 3750388

ANTI-OXIDANTS

Elegant Enterprises, 502, Cotton Exchange Building, Kalbadevi Road, Bombay 400 002. Tel: 312362 Gram: Elanand.

Olin Chemicals —See under "Acetic Acid".

Parul Enterprises, 2nd Floor, Dharia House, Opp. Vinod Silk Mills, Ashok Chakravarti Road, Kandivli (E), Bombay 400 101. Tel: 8127988.

Vini-Chem Laboratories, 5, Gir-dhari Bhavan, 48, A/B Sadashiv

Cross Lane, Bombay 400 004. Tel: 358578. Gr. FORMALIN

AROMATIC CHEMICALS

Aroma Industries, B-150, DDA Shed, Okhla Industrial Area, Phase -II, New Delhi 110020.

Bush Boake Allen (India) Ltd., — See under "Essences & Flavours".

Gupta & Company Ltd. — See under "Essential Oils".

Harish C. Khosla & Co. — See under "Essences & Flavours"

ASEPTIC FLUID HANDLING SYSTEMS

Sanitech Engineers, 107, Vardhaman Complex, Fitwell House Compound, L. B. S. Marg, Vikhori (West), Bombay 400 083. Tel : (022) 5785139. Telex : 11-71978 BOEX IN. Tel : (022) 5785139.

ASEPTIC PACKAGING

Indec Equipment Pvt. Ltd., 105 Veena Indl. Estate, Off Veera Desai Rd., Andheri (W), Bombay 400058 Tel : 8267519 Fax : (091) 22-8267519

AUTOCLAVES

Fabdecon Engineers — See under "Agitators".

M. F. Marketing Pvt. Ltd., B-15, Arjun Centre, B. S. Devshi Marg, Govandi, Bombay 400 088. Tel : 5557515 / 5560947. Fax : 01-22-5560569.

Pushkaraj Enterprises — See under "Fluid Extraction Plants".

United Technologie — See under "Conveyor".

AUTOMATIC FORM-FILL - SEAL MACHINES

Unique Flexo Packaging, Gala No. B-270, Off Kasturi Plaza, Joshiwadi, Dombivli (E), 421 201. Tel.: 5785723.

AUTOMATION SYSTEMS

Tata Honeywell Limited, Hadapsar, Pune 411 013. Tel: 0212-675532/4/5, Tlx.: 0145-7324 Fax: 0212-675992

BAG CLOSERS

Plasto Pack, B-15 Mugappair (W) Industrial Estate, Behind Wavin, Madras 600 050. Tel. 655203/656283.

Shaco Enterprises, 161 Raja Ram Mohan Roy Rd., Prathana Samaj Corner, P. O. Box 3635, Bombay 400 004. Tel : 3864646 /

352343. Fax : 022-3630739.

BAKERY / BISCUIT EQUIPMENT

AdmirEngineers, 11E-4 Shivaji Nagar, Govandi, Bombay 400 043. Tel: 5511718/5518446/5518182.

Advance Equipment Company — Secunder "Airconditioning/Refrigeration Plant & Equipment".

Continental Equipment India Pvt. Ltd., 1E/1 Jhandewalan Extension, Link Rd, New Delhi 110 055. Tel: 521282 & 7524767. Cable: Efficient. Tlx: 031-66706 CANT IN. Fax : 011-7524767

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Grovers Private Limited, 228, Kaliandas Udyog Bhavan, Near Century Bazar, Bombay 400 025. Tel: 4303223/4309935/4309467. Tlx.: 011-71672. GRIN IN. Cable GROFROST.

J.M.B. Engineering Works, Shop No. 2, Shed No. 3, Kodivitta Road, Behind Diamond Restaurant, Andheri (E), Bombay 400 059. Tel: 8363113/8380538.

Reimelt Engineering India Pvt. Ltd. 6, Prachi Off B'tar Rd., 913 Deccan Gymkhana, Pune 410004. Tel: 344607.

Sakav Enterprises — See under "Air Driers".

Sudershan Industries, 563, Guruwar Peth, Kasture Chowk, Pune 411042. Tel : 446885.

BAKING POWDER

Ajmera Chemical Works, 6/104, Garodianagar, Ghatkopar (E), Bombay 400 077. Tel: 8129212 / 8110114.

Lakh Enterprises, 182, Yusuf Meherali Road, 1st Floor, Bombay 400 003. Tel : 3720957, 3756498. Tlx : 011-7509 PLOIN (ICT 85) Gram : 'BRISTAFOD'.

BALANCES, ELECTRONIC

Lab Instruments, 78(B) Jaganath Sankar Seth Rd., "Ratnadeep", (Near Roxy Cinema) Opera House, Bombay 400 004. Tel : 3610973 Fax : 3634619

BARRELS

Fine Plast Ind. Pvt. Ltd. — See under "Crates, Plastic".

Ratnajeet Polycon Ltd., 2, Jawahar Nagar, S.V. Road, Gore-

gaon (West), Bombay 400 104, Tel 8727479 / 8727480, Fax : 91-22-873 7071.

BATCH CODER

Codex Enterprises, 601 'A' Block, 6th fl., B.G. Towers, O/S Delhi Gate, Ahmedabad 380 004.

BATCHING SYSTEMS

Chadha Sales Pvt. Ltd. — See under "Bakery/Biscuit Equipment"

BED DRYERS

Thermax Limited, Chinchwad, Pune 411 019. Cable: THERMAX Fax: 0212-772049.

BELTINGS

Simplicity International, 16, Community Centre, Mayapuri, Phase-1, New Delhi 110 064. Tel: 531311/531407/500109. Tlx: 031-76072 SMPIN. Fax: 91-11-504841

Unnati Corporation — See under "Adhesive Tape, PTFE, Glass".

BENZOIC ACID

Ganesh Dehydride Ltd.—See under "Additives, Food & Beverage"

BHA

Amit Fine Chem. — See under "Agar Agar (Powder / Strips)".

Parul Enterprises — See under "Agar Agar (Powder / Strips)"

Sesu Trading Corpn. — See under "Acids".

BHATTIES, KEROSENE/ DIESEL

Liberty Industries A-1/3 Shivaji Indl. Assoc., Vakola Bridge, Santacruz (East), Bombay 400 055. Tel : 8365774/8375887/6120301.

BISCUIT MAKING MACHINES

Frigmaires Engineers — See under "Agitators".

Mangal Engineering Works, Factory Area, Patiala 147 001, Pb. Tel: 74169/77206. Grams: MAN-GAL. Telex: PCO-216.

Nagpal Brothers (Regd) — See under "Bread Plant".

BLENDERS & MIXERS

Cosywo Engineering Co. — See under "Agitators".

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Mamko Process Equipment

Manufacturers — See under "Emulsifiers".

United Technologie — See under "Conveyor".

BLISTER FOIL

Imperial Packaging Products, 720 Cotton Exchange Bldg., Kalbadevi Road, Bombay 400 002. Tel : 2054810/205 8391

BLISTER PACKING MACHINES

Elmach Packages (India) Pvt. Ltd., 410 Hill View Indl. Estate, Off. L.B.S. Marg, Ghatkopar (W), Bombay 400 086. Tel: 275676/276184.

Package India, W-115A, 111 Avenue, Anna Nagar, Madras 600 040. Tel: 6214555.

BOILERS

Cinni Engineering Pvt. Ltd., 'Rainbow Indl. Estate, Behind Arvind Works, 'Vyaravali', M.I.D.C., Andheri (E), Bombay 400 093. Tel: 8328887/ 8300278 Gr. TECHITHERM.

Compact Boilers Pvt. Ltd., 44, Yusuf Building, 4th Floor, Veer Nariman Road, Bombay 400 023. Tel: 2049669/2042001./2044592 Gram : COFTISOLER.

Energy Machine, C1, B/423 G.I.D.C. IV Phase, Vithal Udyog nagar, Vallabh Vidyanagar, Gujarat 388 121. Tel: 31493.

Fuelpac Boilers & Engg. Co. (I) Pvt. Ltd., H-94 Gujarati Society Nehru Rd., Vile Parle (E), Bombay 400 057.

Jaya and Company, Boiler Engineers, 30, PNR Naidu Layout Trichy Road, P.B. No. 3740, Coimbatore 641 018 (Tamil Nadu). Tel 23994/26416. Grams : Boiler Telex : 855/381 JAYA IN.

Kalpna Boilers and Chemical Plants Mfg. Co., 18, Kailas Park Chirag Nagar, L. B. S. Marg Ghatkopar (W), Bombay 400 086. Tel: 5125352/5129796.

Maxima Boilers Pvt. Ltd., G 14, Meghal Service Indl. Estate Devidayal Road, Mulund West Bombay 400 080 Tel: 5612759

Ross Enterprises, 33, Burhan Indl. Estate, Kondhwa BK, Pune 411 048. Tel: 676518/652210

Soft-Dion Water — See under "Demineralizers".

Watrion Water & Filter Engg Pvt. Ltd., 1 Harishivam Apts., Behind New Canara Bank, Andheri West, Bombay 400 058. Tel 6247200 Grams : WATERFALL

BOILER FEED PUMPS

Raj Pumps, P. O. Box 90, M. I. Rd., Jaipur 302001 Tel : 372308/372949

BOPP PACKING TAPES

Acme Packaging, 10, Topiwalla Mansion, 1st Fl., Above Patel Restaurant, 93/97, Mohamadali Road, Bombay 400 003. Tel: (Off.) 3432601 (Resi) 8725294

Polypak Products — See under "Adhesives/Adhesive Tapes".

BOTTLE CLOSURE MACHINERY

Advance Packaging, 10/65, Industrial Area, Kirti Nagar, New Delhi 110 015. Tel: 53 2388/ 541 0629 (R) 544 8110/544 9347.

Larsen & Toubro, Packaging Section, 32 Shivaji Marg, P. O. Box 6233, New Delhi 110015.

BOTTLE COOLERS

Continental Equipment India Pvt. Ltd. — See under "Bakery/Biscuit Equipment".

BOTTLE FILLERS

Fillopack Industries, Unit No.2, Vijay Indl. Estate, I. B. Patel Road, Goregaon (E) Bombay 400 063.

Rita Bottling Machines Pvt. Ltd., 55, III Main Rd., Gandhinagar, Adyar, Madras 600020. Tel : 412698/419029 Tlx : 41-21045 RITA IN

Unique Flexo Packaging — See under "Automatic Form-Fill-Seal Machines".

BOTTLES & JARS, GLASS

A to Z Bottle Suppliers, 10A Pais Street, Clerk Rd., Stable No. 4, Byculia West, Bombay 400 011. Tel : 3082381 / 3727241

Divecha Glass Industries, 155, Maker Chambers VI, 220 Nariman Point, Bombay 400 021. Tel: 241157/241167

R.G. Glass Agency, 244, Maulana Azad Road, (North) Opp Urdu Times, Post Box No. 4564, Bombay 400 008. Tel: 307236/3086984/3099896/3096218. Grams: SUPERGLASS

Star Glass Works, 299, Kurla Andheri Road, (Jari Mari), Bombay 400 072. Tel: 5111211/5111827/8. Cable: STARBOTTLE. Fax : 011-73345 SGW IN.

BOTTLE INSPECTORS

J.T. Jagtiani — See under "Machinery, Food & Beverage Processing".

BOTTLING PLANTS

Dairy Udyog, C 229A, Ghatkopar Ind. Estate, L. B. S. Marg, Ghatkopar, Bombay 400086. Tel: 586878/583636. Grams: DAIRYUDYOG. Bombay - 86.

Frigmaires Engineers — See under "Agitators".

Geeta Food Engineering — See under "Food Processing Equipment /Plants."

Hilden Packaging Machines Pvt. Ltd., Plot 101 Rd., 16, MIDC, Marol, Andheri (E), Bombay 400 093. Tel: 8322251/8329193/6329263. Grams: PACK BOTTLE.

J. T. Jagtiani — See under "Machinery, Food & Beverage Processing".

Liberty Equipments P. Ltd. 373, SIDCO Industrial Estate, Ambatur, Madras 600 098. Tel: 044-655081. Fax: 91-44-869900.

The Master Mechanical Works Pvt. Ltd., Pushpanjali, S.V. Road, Santa Cruz (W), Bombay 400 054. Tel: 6493459/6491680/6490619. Gr. : ROLLSEALER.

BOTTLE WASHERS & RINSERS

Acmevac Sales Pvt. Ltd., 109, Unique Industrial Estate, Cardinal Gracias Road, Chakala, Andheri (E), Bombay 400 093. Tel: 8329647/8300619.

BOTTLE WASHING MACHINES

The Royal Scientific Industries, 22, Sarojini St., T. Nagar, Madras

600018. Tel: 443821. Fax: 91-11-837372.

BOX MAKING MACHINERY

Paper Board Machinery Co., Plot No. 115, D.L.F. Industrial Area, Part-I, Faridabad 121003, Haryana. Tel : 011-8275394/011-8275894. Gram : Paper Board Faridabad. Fax : 011-8275394.

BOX STITCHING MACHINES

Venus Industries, B-6 Mayapuri Phase-II, New Delhi 110064. Tel : 5403148/5401321, Tlx : 3176252 KRF-IN Grams : STITCHERS, Fax: 011-5436957.

BREAD KNEADING MACHINE

Fabdecon Engincers — See under "Agitators".

J.M.B. Engineering Works — See under "Bakery/Biscuit Equipment".

BREAD PLANT

Nagpal Brothers (Regd.) 2789, Hamilton Rd., (Zorawar Singh Marg), Mori Gate, Delhi 110 006. Tel: 2518412/2911888, Cable: NAGBAKERY Fax: 011 2923059.

BREWERY PLANT & EQUIPMENT

Chemi Filter Corporation, 1/C-16, "Geebee" Apartments, Sai Baba Nagar, Borivli (W), Bombay 400 092.

Flocon Industries, 542, Akurli Road, Fonseca Compound, Near

Old Post Office, Kandivali (E), Bombay 400 101. Tel: 8886265.

CAKE MIXING MACHINES

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

J.M.B. Engineering Works — See under "Bakery/Biscuit Equipment".

Nagpal Brothers (Regd) — See under "Bread Plant".

CALCIUM ALGINATE

Burzin and Leons Agenturen Pvt. Ltd. — See under "Additives, Food and Beverage".

CALCIUM CARBONATE

Citurgia Biochemicals Ltd. — See under "Acids".

CAN CLOSING & SEAMING MACHINES

Cantech Machines, 13, Vora Bhavan, King's Circle, Matunga (C.R.), Bombay 400 019. Tel: 4096086 / 4096853. Fax: 91-22-4371397

Ganga Singh Sukhwinder Singh & Sons — See under "Canning Machinery & Plants".

Recon Machine Tools Pvt. Ltd., 35, Sarvodaya Industrial Estate, Mahakali Caves Road, Bombay 400 093. Tel: 400 093. Tel: 8344973/8343931.

CAN FILLING MACHINERY

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Grams : ACCUWEIGH

under "Automatic Form-Fill-Seal Machines"

CANDY PACKING MACHINES

New Indo International — See under "Food Processing Equipment/Plants"

CAN TESTERS

Recon Machine Tools Pvt. Ltd. — See under "Can Closing & Seaming Machines".

CANNING MACHINERY & PLANTS

Ganga Singh Sukhwinder Singh & Sons, 1 Vishal Ind. Estate, Village Rd., Bhandup (W), Bombay 400 078. Tel.: 5600562 / 5649312 Fax : 0091-22-5649312

CANS & CONTAINERS

Standard Tin Works — See under "Caps & Closures".

The Tinplate Co. of India Ltd., Golmuri, Jamshedpur 831 003 Tel: 25796. Gram: TINPLATES.

CAPPING EQUIPMENT

Frigmaires Engineers — See under "Agitators"

United Technologie — See under "Conveyor".

CAPPING MACHINES

Autopack Machines Pvt. Ltd., 101-C, Poonam Chambers, 1st Fl., Dr. Annie Besant Road, Worli, Bombay 400 018. Tel: 4924926.

CAPS & CLOSURES

Standard Tin Works, Standard House, D'Souza Compound, Safed Pool, Kurla-Andheri Rd., Bombay 400 072. Tel: 5112758/5125605/5150975. Tlx : 011-73566 LALA IN, Fax : 91-22-5134851.

CARAMEL FOOD COLOUR

Flavour India Private Ltd., C-5, 14 & 23, Pipdic Industrial Estate, Pondicherry - 605 009. Tel: 27833.

Konam Enterprises, 135 Pantnagar, Opp. Ghatkopar (E) Stn., Bombay 400075. Tel : 516 5345 / 511-1853.

Tajir Private Ltd., Adie Mansion, 334 Maulana Shaukatali Rd., Bombay 400 007. Tel : 3073314, 3078776, Fax: 3072757. Tlx: 011-75809 ALIF IN

CARBON DIOXIDE GAS GENERATING SYSTEMS

Deltech Engineering Pvt. Ltd., Laz Gunza, Shantivihar Complex,

140, Royapcttah High Road, Madras 600 004. Tel: 77288.

CARBOYS

B.K. Polyplast (A Divn. of B.K. Paper Mills Pvt. Ltd.), 1301-1318, Dalamal Tower, 211, Nariman Point, Bombay 400 021. Tel: 2834906/2834995.

CASEIN

Lacto Protein India Ltd., D-17 Panch shila Enclave, New Delhi - 110 017. Tel : 91-11- 6442474/6450337 Tlx: 31-70098 ACE IN. Fax: 91-11-6410493

S. P. Jagdish & Co., 1222, Stock Exchange Towers, Dalal Street, Fort, Bombay 400 001. Tel: 271212/271717. Grams: CASIN-MAKER. Tlx: 011-85629.

Venus Casein Products, 170, G.I.D.C Estate, Mehsana 384002, N. Gujarat. Tel : (O) 22121 (R) 22566.

CATERING EQUIPMENT

Bhagwati Udyog, A-55, Wazirpur Indl. Area, Post Box No. 8488, Delhi - 52. Tel.: 741445, Fax: 91-11-733-4544.

CELLULOSE PRODUCTS

Uttam Corporation, 194, 10th Rd., Khetwadi Main Rd., Bombay 400 004. Tel : 357488/3870568/356466/3883089 Grams: UTTAMCHAND. Tlx : 11-71567 UTTM IN Fax : 22-387-0461

CENTRIFUGES

Filtron India, Sparc, 117-A, Vithalwadi Road, Pune 411 030. Tel: 440068/444079. Grams : NORTLIF. Telex: 0145-323 TRON IN. Fax : (0212) 440068.

Frigmaires Engineers — See under "Agitators"

Kalpna Boilers & Chemical Plants Mfg. Co. — See under "Boilers".

CHAIN CONVEYORS, BOTTLE & CAN

Albro Trading Company, 42-44, Bhajiwala Street, Bombay 400 003. Tel: 324336/347116/341194.

Moldex Corporation, A/9, New Empire Ind'l Estate, Kondivita Road, Andheri (East), Bombay 400 059 Tel 8300618.

CHEMICALS, FINE

Balaji Dye Chem — See under "Acids"

M. M. Chemicals — See under "Acids"

Olin Chemicals — See under "Acetic Acid".

Sesu Trading Corporation — See under "Acids".

Thirumalai Chemicals Limited — See under "Acids".

Uttam Corporation — See under "Cellulose Products"

CHEMICAL PLANT & EQUIPMENT

Fabdecon Engineers — See under "Agitators"

Frigmaires Engineers — See under "Agitators"

United Technologie — See under "Conveyor"

CHILLING PLANTS

Grovers Private Ltd. — See under "Bakery/Biscuit Equipment"

CHLORINATORS

Chloro Control Equipments Co., 13/M-E Laxmi Industrial Estate, New Link Rd., Andheri (W) Bombay 400 058. Tel.: 8266891. Tlx: 011-78092 KOCH-IN, Gr. ADVANCE.

CHOCOLATE MAKING MACHINES

Fabdecon Engineers — See under "Agitators"

Frigmaires Engineers — See under "Agitators"

CITRIC ACID

Acc International — See under "Guar Gum".

Alok Chem Corporation — See under "Guar Gum".

Balaji Dye Chem — See under "Acids".

B. I. Mehta — See under "Acids".

Citurgia Biochemicals Ltd. — See under "Acids".

Sesu Trading Corporation — See under "Acids".

CITRIC ACID / ANHYDROUS

Amrit Fine Chem. — See under "Agar Agar (Powder/Strips)"

Parul Enterprise — See under "Agar Agar (Powder/Strips)"

CLARIFICATION SYSTEMS

Krofta Engg. Ltd., S.C.O. 55, Madhya Marg, Sector 26, Chandigarh 160019. Cable: Krofta, Chandigarh. Tel : 22115/22124.

CLEANING / GRADING MACHINERY

Goldin (I) Equipment Pvt. Ltd.,

1st Floor, Saraswati Estate, Opp. Chhana Jakat Naka, Vadodara 390 002. Tel : (0265) 21452 / 21949.

COCOA POWDER

Balaji Dye Chem — See under "Acids"

Sesu Trading Corporation — See under "Acids".

CODING/NUMBERING MACHINES

Numerators India, 3/6 Marris Road, Mendu Compound, Aligarh 202001. (U.P) Tel : (0571) 25910. Grams : NUMERATORS.

COLD STORAGE PLANT

Air Frige Industries — See under "Airconditioning/Refrigeration Plant & Equipment".

'METACOLOR', Shree Precoated Steel Ltd. — See under "Refrigeration Equipment & Plant".

Transair — See under "Air conditioning/Refrigeration Plant & Equipment".

COLOURS, FOOD & BEVERAGE

Asim Products — See under "Food Colours, Food & Beverage".

Bush Boake Allen (India) Ltd. — See under "Essences & Flavours".

Devarsons Pvt. Ltd. Shreeji Niwas, Astodia Road, Ahmedabad 380 001. Tel: 342796/345599.

Sesu Trading Corporation — See under "Acids".

Vino Synth Chem Pvt. Ltd. — See under "Food Colours, Food & Beverage".

COMPOSITE CONTAINERS (LEAK PROOF)

Consolidated Containers (I) Ltd., 8, Anupam Indl. Est., 2, L.B.S. Marg, Mulund (W), Bombay 400080. Tel: 5614902, 5618942 Fax: 0091-22-261-2659 (CCIL)

CONCENTRATES & EXTRACTS

Agro Foods Punjab Ltd., Seed Farm Road, Abohar 152 116. Tel: 21415. Grams: FARM AID

Fabdecon Engineers — See under "Agitators"

Gupta & Company Ltd. — See under "Essential Oils"

CONSULTANCY & DESIGN

Agro Hi-Tech, 23 New Rajamandi Colony, Agra 282002.

(Agro-based / Mushroom Cultivation)

Dr. T. K. Food Consultants, 2A, 4th Floor, Lentin Chambers, Dalal Street, Fort, Bombay 400 023. Tel: 2657206/2651864.

Scope Marketing Pvt. Ltd., 30/1 South Boag Rd., T. Nagar, Madras 600017.

Subhash Gupta & Associates, C-430 East of Loni Rd., Shahadra, Delhi 110 093. Tel: 2294730.

CONTAINERS, PET/PLASTIC/METAL

Crystal Containers, 38-42, Shamsset Street, Bombay 400-002. Tel: 342269, 331961.

Gaurav Containers Ltd., Kaker Chamber V, 1412, 13th Floor, Nariman Point, Bombay 400 021.

Pearl Polymers Limited, F-44, Bhagat Singh Market, (Near Gole Market), New Delhi 110 001. Tel: 351152/351160 Tlx: 031-65493 PARL IN. Fax: 011-331-1601.

Swastik Industries 34/C, Thakker Building, Ground Flr., Gala No. 4, Champsi Bhimji Road, Next to Shrinivas Bldg., New Post Office, Old Anjirwadi, Mazagaon, Bombay 400 010 Tel: 8729366.

CONTAINERS & CUPS, DISPOSABLE

Circle KS Polyset Industries Pvt. Ltd., 114, 4th Hindu Colony, Bombay 400 014. Tel: 4145094/4142869 Tlx: 011-75490 CKS IN.

Tropical Cups & Containers 16/76, Gokuldas Pasta Road, Next to Hotel Red Rose, Behind Chitra Cinema, Dadar (E), Bombay 400 014. Tel: 4137843/44/45.

CONTRA-ROTARY MIXER

Metal Plants, 2/17, Anupam Ind. Estate, Lal Bahadur Shastri Marg,

Mulund, Bombay 400 080. Tel: 5614439/5610628

CONTROLLERS

Flow, Liquid Level, Temp. Misc.

Sakav Enterprises — See under "Air Driers".

CONVEYOR, ROLLER

Ferro Foundries Private Ltd., Yelwal Road, Belvadi P.O., Mysore 571186, S. India. Tel: 42376 Gr: FOUNDRY Tlx: HUNSPLY 0846-224

Interroll (India) Pvt. Ltd., Joki Division, 17, Community Centre, Mayapuri Phase I, New Delhi 110 064. Tel: 531311/531407/500109

CONVEYER BELTS & CHAINS

Wiperdrive Engineering, Noble Chambers, gr. fl., 11 Janmabhoomi Marg, Fort, Bombay 400 001. Tel: 2871995/2871855 Fax: 022-287-3597

CONVEYORS

United Technologie, B3/201, Ashokvan, Borivli (E), Bombay 400 066. Tel: 851133. Fact: Parikh Ind. Estate, Gala No. 2, 10 & 19, Chandansar Road, Virar (E), 380 001.

COOLING TOWER PUMPS

Raj Pumps—See under "Boiler Food Pumps"

CORK LINERS

Vora Cork Industries Pvt. Ltd., Lobo Compound, Opp. Tip Top Hotel, Sakinaka, Bombay 400 072. Tel: 46342/43, Fax: 91-22-5125370.

CORROSION INHIBITORS

Manikant Bros. — See under

"Anti Corrosion Chemicals"

CRATES, PLASTIC

A-1 Plastics — See under "Containers, PET/Plastic/Metal".

Bright Brothers Limited, 35-C, Pt. M.M. Malviya Rd., Bombay 400 034 Tel: 4945342-46 Tlx: 011-75066 IN Fax: 022-4947596

Fine Plast Industries Pvt. Ltd., Sales Off: 85, Sarang St., Taher Bldg., 1st Floor., Bombay 400 003. Tel: 2999129/256734. Tlx: NPAI 011-3818-IN. Gr: "POLY-DRUMS".

Nilkamal Crates & Containers, 5, Rewa Chambers, 1st fl., New Marine Lines, Bombay 400 020 Tel: 255746/79, 295251. Cable: CRATES.

V. I. P. Industries Ltd., Leo House, 5th fl., 88-C Prabhadevi Rd., Bombay 400 025.

CREAM FILLING MACHINE

Frigmaires Engineers — See under "Agitators"

United Technologie — See under "Conveyor"

CREAM SEPARATOR

Naveen Scientific Industries, Post Box 67, Lactowin House, Near B. D. School, Ambala Cantt. Tel: 643092, 24591. Gram: LACTOWIN

CREAM OF TARTAR

Alok Chem Corporation, 406, Goradia House, P.O.B. 13048, 100/104, Kazi Syed Street, Bombay 400 003. Tel: 326390/325365 (R) 5610002/6238090.

Amit Fine Chem. — See under "Agar Agar (Powder / Strips)".

B.I. Mehta — See under "Acids".

Thirumalai Chemicals Limited See under "Acids"

CROWN CAP PVC LINING MACHINE

Venus Packaging Services, 302 Palm Beach, Versova, Bombay 400 061 Tel: 6264835 Fact: 8113623/8113121/8113122

CROWN CAP MACHINERY

Venus Packaging Services — See under "Crown Cap P. V. C. Lining Machine".

CROWN CAP PUNCHING PRESS

Venus Packaging Services — See under "Crown Cap P. V. C. Lining Machine".

CROWN CORKS

Standard Tin Works — See under "Caps & Closures"

CROWN CORKING MACHINES

Advance Packaging — See under "Bottle Closure Machinery".

Thihari-Ot Engg. Co., 16, Poppy Apartment, 3rd Floor, Ram Nagar, S. V. Road, Borivali (W), Bombay 400 092. Tel: 8054033.

CULTURE MEDIA

Hi-Media Laboratories Pvt. Ltd., 23, Vadwani Industrial Estate, L.B.S. Marg, Bombay 400 086. Tel: 5150970/5151607 Fax: 00-91-022-5112468

DAIRY PLANT & EQUIPMENT

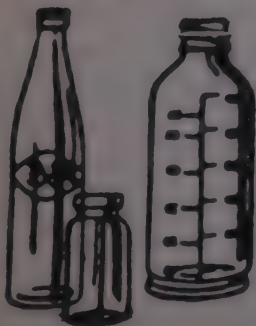
Alfa-Laval (India) Ltd., Bombay - Punc Road, Dapodi, Punc 411 012. Tel: 86321 (8 Lines) Tlx: 0146-219/259/326 ALL IN.

Chadha Sales Pvt. Ltd., 137, Rajindra Market, Tis Hazari, Delhi

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R. G. GLASS INDUSTRIES



Specialists in : EMPTY SODA AERATED WATER (SOFT DRINKS) BOTTLES, PLASTIC & WOODEN CRATES, WHOLE-SALE DEALERS IN EMPTY NEW GLASS BOTTLES IN WHITE, AMBER & GREEN MANUFACTURED ON FULLY AUTOMATIC PLANT

11-B, Petwalla Compound, 244, Maulana Azad Road (North), Opp. Urdu Times, Near Nagpada Junction, Bombay - 400 008.

110054. Tel : 2518477/2511416, Fax : 2914211

Continental Equipment India Pvt. Ltd. — See under "Bakery / Biscuit Equipment".

D. G. S. Company, Dairy Engineers, 13 GIDC V. U. Nagar 388121, Anand, Guj. Tel : 30318/232224 Grams : DIJISHA, ANAND.

Dairy Farm Equipment (I) Ltd., Flat No. B2, Malati Co-op. Hsg. Society, Senapati Bapat Rd., Pune 411 016. Tel : 342456. Fax : 0212-342456.

Frigmaires Engineers — See under "Agitators"

Filtron Engineers Pvt. Ltd., C/o. Sparc, 117-A, Vithalwadi Rad Pune 411 030. Tel: (0212) 44068/444079. Fax: (0212) 447949 Tlx: 01 45-323 TRON IN

Hitech Ultraviolet Pvt. Ltd., C-14 Grace Plaza, S. V. Rd., Jogeshwari (W), Bombay 400102. Tel : 628645 / 6282517 Fax : 6206702.

'METACOLOR', Shree Precocated Steel Ltd. — See under "Refrigeration Equipment & Plant".

Saffaire India — See under "Air Conditioning/Refrigeration Plant & Equipment".

United Technologie — See under "Conveyor".

DEHYDRATION MACHINERY

International Food Machinery, Krishna, Opp. Deep Bhavan, Pandit Nehru Marg, Jamnagar 361008. Tel : 72344 / 72567. Gram : EAGLEEXPORT.

DEHUMIDIFIERS

Arctic India Sales 20, Rajpur Road, Delhi 110054. Tel: 2522424/231129. Tlx: 031-78003 AISL IN.

DEIONISERS

Soft-Dion Water — See under "Demineralisers".

DEMINERALIZERS

Bry-Air India Ltd. — See under "Dehumidifiers".

Soft-Dion Water, 75, Laxmi Building, 4th Floor, Sir. P.M. Road, Fort, Bombay 400 001. Factory: Opp. Laxmi Talkies, Ambarnath Badliapur Road, Ambarnath 421 501 Tel : 2861529/2861516 Grams SOFT DION Ambarnath

DESTONER, VACUUM TYPE

Golda (India) Equipment Pvt.

Ltd. — See under "Cleaning/Grading Machinery".

DETECTION EQUIPMENT, Fire/Smoke, etc.

Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi P.O., Prabhadevi, Bombay 400 025. Tel: 4224461/4303047.

DIGITAL MOISTURE ANALYSER

Innovative Instruments, 125, Mahajan Society, Fatehganj, Vadodara 390 002. Tel: (0265) 21084

DISPENSERS, BEVERAGES

Frigmaires Engineers — See under "Agitators"

Varun Ref-Air, 115, 3rd Flr., Nahar & Seth Indl. Estate, Bhandup, Bombay 400 078. Tel: 5649890/5641599.

DRYERS - BOTTLE / TRAY

The Royal Scientific Industries — See under "Bottle Washing Machines".

DRYERS, OVEN/TRAY, ETC.

Agro Engineering Products (Delhi) P. Ltd., 30 South Extension Part-I, New Delhi-110049. Tel: 698928/617928, Tlx : 03-61287 AEECIN. Gram: AGROPRODUCT Fax : 011-617928.

Fabdecon Engineers — See under "Agitators"

Kailash Scientific Co., 28 Universal Indl. Estate, I. B. Patel Rd., Goregaon (E), Bombay 400 063. Tel : 8734735, 8731836.

SSP Pvt. Ltd. -- See under "Evaporators".

Sakav Enterprises — See under "Air Driers"

E. VANILLIN

Balaji Dye Chem — See under "Acids".

ELECTRONIC SCALES

Accurate Weighing Machines — See under "Weighing Machines".

EMULSIFIERS

Cosywo Engineering Co. — See under "Agitators"

Eskeyar Engg. Co. (P) Ltd., 10/5, Developed Plot, Ambattur Industrial Estate, Madras-600058. Tel : 654137/76046 Grams:

Designesk, Fax : 91-44-76047.

Frigmaires Engineers — See under "Agitators".

Kapadia Gum Industries, G.P.O. Box No. 1160, 3 Mint Road, 2nd Floor, Opp. G.P.O. Bombay 400 001. Tel: 261087/265073/267217. Grams: PHARMAGUM.

Lara Engineers — See under "Agitators".

Mamko Process Equipment Manufacturers, Post Box No. 19001, Bombay 400 063. Tel : 8886309/8889913. Gram : MIXIN Bombay 400 063. Fax : (91 22) 8822757.

United Technologie — See under "Conveyor".

ENGINEERS & DESIGNERS CONSULTING (See also under "Consulting & Design")

BASP Industries, G.P. Industries Compound, 96, Panch Pakhadi, P.O. Wagle Industrial Estate, Thane 400 604. Tel: 594775/505425.

Dalal Consultants & Engineers Pvt. Ltd., 44, Dr. R. G. Thadani Marg, Worli, Bombay 400 018. Tel : 4934821/22/4937669/4937570.

Forsberg Agritech (India) Pvt. Ltd. — See under "Grains & Cereals Cleaning / Grading Machinery".

Frigmaires Engineers — See under "Agitators".

Mahendra Consultants P. Ltd., C-5, Chirag Enclave, New Delhi 110 048. Tel: 6416003 & 4. Grams : RELIANCE Telex: 66290 GTI IN Fax: 6467690.

ENZYMES

B.I Mehta — See under "Acids".

Olin Chemicals — See under "Acetic Acid".

Rathi Papains Pvt. Ltd., 105/106, Dhanlaxmi Industrial Estate, Opp. Golden Dyes, Old Agra Road, Thane (W) 400 601. Tel: 534 4011/534 3445/534 6928. Fax: 91-22-2872811. Cable: PAPAINS.

EPOXY COATING

Manikant Brothers — See under "Anti-Corrosion Chemicals".

EPS PLASTIC CONTAINERS

Siltap Chemicals Ltd., E.P.S. Division, 17/18, Shah Industrial Estate, Veera Desai Rd., Andheri (W), Bombay 400 058 Tel:

8267260/61/63/64/65

ESSENCES & FLAVOURS

Aroma Industries, 128/14C, Kidwainagar, Kanpur 208 011, U.P.

Bush Boake Allen (India) Ltd., 1-5, Seven Wells Street, St. Thomas Mount, Madras 600 016, T.N. Tel: 431131 Grams: ABRACOL-MADRAS Tlx: 041 26058 BBA IN.

Feroze Foods & Flavours, 403, Central Tin Est., F. Kondeo Marg, Sussex Road, Byculla, Bombay 400 027. Tel: 8729724/8114972.

Gogia Chemical Industries — See under "Essential Oils".

Harish C. Khosla & Co., Zinat Mahal, Lalkuan, P.O. Box 1328, Delhi 110 006. Tel: 7524803/733160 Gr: THYMOL Tlx: 62267 HCK IN

M. C. Davar Aromatics Pvt. Ltd., 266, B. J. Dadaji Marg, Hormazd Mansion III Floor, Opp Bhatia Hospital, Tardeo, Bombay 400 007. Tel: 359468 Tlx: (11) 85892 DAVR IN.

Sonarome Chemical Pvt. Ltd., Peenya Industrial Area, II Stage, Bangalore-560058, Tel : 395595/394804. Grams : Sonarex, Bangalore - 94. Tlx : 845-8848 ITBO-IN, Fax : 80-334802.

Spac Aromas, P. B. No. 6874, Bombay 400 057. Tel: (O) 319724/317571. Fact: 634 5574/6340543. Grams: AROMASPAC, Bombay 2

Ultra International Pvt. Ltd., 304, AVG Bhawan, M-3, Conaught Circus, New Delhi 110 001. Tel: 91-11-3324100/3324200 Tlx: 31-61558 SANG IN.

Universal Flavours & Fragrances, 133, New Apollo Estate, Mogra Village Road, Andheri (E), Bombay 400 069. Tel : 8322631/8200106. Gr: JEPYPATEL, Bombay 49.

Vin Flavours — See under "Additives, Food & Beverage"

ESSENTIAL OILS

Bhagat Impex P. Ltd., 164, Sitaram Poddar Marg, Bombay 400002. Tel : 2060785, 2086587/6852. Tlx : 011-85356 BFCL IN. Fax : 022-2060638.

Calcutta Essence Supply Co., 41, Ezra St., Calcutta 700 001. W.B. Tel: 266861 Grams: SUGANDHI.

Gogia Chemicals Industries, A-127, Okhla Industrial Area, Phase

II, New Delhi 110 020. Tel: 6836007/6303329. Gr: ORANGE OIL. Fax: (91) (11) 6840763

Gupta & Company Ltd., XIV/294, Gali Mandi Pan, Sadar Bazar, Delhi 110006. Tel: 7774742 / 528923 / 527795 Tlx: 31-66075 GCPL-IN. Fax: 011-7519215 Cables: AROMA DELHI 110006.

Harish C. Khosla & Co. — See under "Essences & Flavours".

Manak Citrus Products P. Ltd., At & Post: Utran, Dist. Jalgaon 425 001, Pachora -70.

Olin Chemicals — See under "Acetic Acid".

Srilarome, FF-7 Greenery, 16 Plain Street, Bangalore 560 001. Tel: 5592751 Fax: 91-80-5592751

EVAPORATORS

SSP Pvt. Ltd., 19 DLF Indl. Area II, 13/4 Mathura Rd., Faridabad 121003 Tel: 82-75441/ 8277730/8275968, Gram : ESESPEE. Tlx: 034-286 SSP IN

United Technologie — See under "Conveyor".

EXTRUDERS

Dr. TK Food Consultants & Exporters — See under "Consultancy & Design".

Do-Well Oil Plants Pvt. Ltd., 306 Manish Commercial Centre, Dr. Annie Besant Rd., Worli, Bombay 400 025. Tel: 4937219/ 4934056 Tlx: 11-75573 DWL IN. Grams: DOTRACT.

Fabdecon Engineers — See under "Agitators".

Trumatic Engineers. 91/18 GIDC Estate, Vatwa, 1st Phase, Ahmedabad 382445. Tel: (0272) 830353. Tlx: 1216611. Fax: (0272) 833148.

FABRICATED EQUIPMENT

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

United Technologie — See under "Conveyor".

FASTFOOD EQUIPMENT

Continental Equipment India Pvt. Ltd. — See under "Bakery/ Biscuit Equipment"

L. L. Equipment & Machines Pvt. Ltd., 35-36/C, L. K. Arcade, Marol Naka, Sir M. V. Rd., Andheri (E), Bombay 400 059. Tel: 8344182/8360843

United Technologie — See under "Conveyor".

FIBRE GLASS ADHESIVE TAPE

Unnati Corporation, 423-425 GIDC Tele. Exch. Lane, Odhav, Ahmedabad, 382415, Tel.: 873434/872277, Tlx.: 121-6816, ANARIN Fax: 272-366505.

FILLING & SEALING MACHINES

Accurate Weighing Machines Co., — See under "Weighing Scales".

Acmevac Sales Pvt. Ltd., - See under "Bottle Washers & Rinsers".

Automatic Devices, 105-A, Hind Saurashtra Industrial Estate, Marol Naka, Bombay 400059. Tel: 832 31376 Gram: AUTOELEC, Andheri, Bombay 400 059.

Crystal Engineering Co. India, WZ-2C/1, Basai Darapur, New Shiv Mandir, New Delhi 110015. Tel: 591628 (R) 2282846.

Eee Cee & Co., 1, Anant Indl. Est, Opp. Comet Fruit & Chemicals, Rakhial, Ahmedabad 380023. (Gujarat) Tel: (O) 368311 (R) 400 860 Grams: EXTRAHEAT.

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Gansons Engineers Pvt. Ltd. — See under "Form-Fill-Seal Machines".

Mamko Process Equipment Manufacturers — See under "Emulsifiers".

Mittal Engineering Works, Plot No. C-30, Road 16, Wagle Industrial Estate, Thane 400 604.

Samarpan Fabricators Limited, Plot A-182/A-183, Road 16/Z, Wagle Industrial Estate, Thane 400 604. Tel: 5321842/5320373/ 5320822/5320029/5320730 Grams : PROPAC Tlx: 011-72329 SEL IN Fax: 91-22-5320033

Unique Flexo Packaging, Gala No. B/270, Joshi Wadi, Off Manpada Road, Dombivli (E), Bombay 421 201.

United Technologie — See under "Conveyors".

FILM, MULTILAYER

Eco Plast Pvt. Ltd., Sona Udyog Bldg. No.4, 2nd floor, Parsi Panchayat Road, Andheri (E), Bombay 400063. Tel: 8325364/8325837 Tlx: 11-79171 VKEP IN Fax: 8366384

ADMIR ENGINEERS

Office :

Plot No. 1/E-4, Shivaji Nagar
Govandi, Bombay 400 043
Tel: Office-cum-Resi : 5518446, 5511718, 5518182

Works :

8/9 M. H. Gajanan Colony, Shivaji Nagar
Govandi, Bombay 400 043
Tel : 5511718

Manufacturers of :

All types and any size of Diesel Fired & Gas Fired Direct & Indirect Automatic Travelling Ovens for Biscuit & Bread Baking, Barrel Drying, Tin Printing, Box Oven & Solutioned Components etc. Specialist in Sheet Metal & Structural jobs undertaken.

Propack Industries, Sona Udyog, Bldg. No. 4, 2nd Floor, Parsi Panchayat Rd., Andheri (E), Bombay 400 069. Tel: 8325364 / 8325837. Fax: 6366384.

FILM WRAPPERS

Ankit Packaging Pvt. Ltd., H. O. 3-6-140 Liberty Rd., Himayatnagar, Hyderabad 500029. Tel: 236645 Grams: CENTPACK

Amol Dicalite Limited, S/4 Navrang Swastik Cross Rd., Navrangpura, Ahmedabad 380009. Tel: (0272) 400408/400458 Fax: (0272) 429103

FILTER AIDS

Perfect Magnets Pvt. Ltd. — See under "Magnetic Separators".

FILTERS

Britomatics — See under "Filtration Systems".

Khanna Bolting Enterprises, 121, 1st Floor, Veenaa Beena Shopping Centre, Near Bandra Station, Bombay 400 050. Tel: 6424565/ 6409535/6422308.

Otoklin, Plot No. 1, Shah. Indl. Area, V. Desai Rd., Andheri (W), Bombay 400 058. Tel: 6267476.

Shriyan & Co., 33 Sunil Shop-

ping Centre, Opp. Navrang Cinema, J. P. Rd., Andheri (W), Bombay 400 058. Tel: 828 6318. Fax: 826 9104/826 9057.

Soft-Dion Water — See under "Demineralizers".

Ultrafilter (I) Pvt. Ltd., Plot No. 70, Bommasandra Indl. Area, Anekal Taluk, Bangalore 562158 Tel: (0812) 220159 Tlx: (08408) 22 UIPL IN Fax: (0812) 422470.

Watrion Water and Filter Engg. Pvt. Ltd. — See under "Boilers"

FILTER PRESSES

Fluid Control Equipments, 77/ 574, Mount Rd., Madras 600 006. Tel: 451159. Gr.: FLUID-CON.

Parksan Filters Pvt. Ltd. — See under "Filtration Systems".

Purity Textile Pvt. Ltd., 12 Krystal Blue, 11th Lane, Near BSES, Santacruz (E), Bombay 400 055. Tel: 6116314/6116137. Tlx: 1178117 - PTPLIN. Fax: 6131348

FILTER PAPER

Lab Instruments -- See under "Heating Mantles"

FILTRATION SYSTEMS

Britomatics, C-9, Nanddham

Indl. Estate, Marol Maroshi Rd.,
Bombay 400 059.

Ion Exchange (India) Limited
Ticcicon House, Dr. E. Moses Rd.,
Mahalaxmi, Bombay 400 001. Tel.:
4939520/23/25/31/32 Tlx.: 011-
73787 IONX IN. Fax: (91) 22-
4942756.

Parksan Filters Pvt. Ltd., G-4
Mahavir Mansion, Plot No. 16,
Garodia Nagar, Ghatkopar (East)
Bombay 400 077. Tel: 5130668

Pharma Concept, G-4 Mahavir
Mansion, Plot No. 16, Garodia
Nagar, Ghatkopar (East) Bombay
400 077. Tel: 5130668/5111222,
Tlx: 011-71515, Fax: 5115904

FLAVOURING COMPOUNDS

Gajraj Agencies, 19,
Bharathiyar, 4th St., S. S.
Colony, Madurai 625016. Tel:
34568. Grams "GAJESSENCE"
Madurai 625 016.

FLAVOURING EMULSIONS

M. C. Davar Aromatics Pvt.
Ltd. — See under "Essences &
Flavours".

FLEXIBLE PACKAGING MATERIAL

Ankit Packaging Ltd. -- See un-
der "Film Wrappers".

FLOUR MILLS

Bemco Agro Implement Pvt.
Ltd., P. O. Udyamabag, Belgaum
5900 008. Tel: 30388. Gram: 5900
BEMCO AGRO. Tlx: 0863-287.

FLOW METERS

Aqua Engineering, 6 Haji
Habib Bldg., 1st Fl., Dr. Ambedkar
Rd., Dadar, Bombay 400 014. Tel:
4110324 Grams: FLOWME.

FLUID BED DRYERS

Flora Engineering Co., A-4/A-
42 Laghu Udyog Kendra, I. B. Patel
Rd., Goregaon (E), Bombay 400
063. Tel: 873-5768 Fax: 91-22
2873059.

FLUID EXTRACTION PLANTS

Pushkaraj Enterprises, 1414, 1B
Sadashiv Peth, Pune 411030, Tel:
0212-446222 Fax: 0212-446222.

FLY KILLERS, ELECTRIC

Opel Industries 135 A, Advani
Industrial Estate, Sun Mill Com-
pound, Lower Parel, Bombay 400
013. Tel: 0212-234926884.

FOAM PLASTIC BAGS

Shreeji Polylaminates Pvt. Ltd.
— See under "Laminated Pouches".

FOOD COLOURS, FOOD & BEVERAGE

Asim Products, 296, Samuel
Street, Room No. 29, 2nd Floor,
Bombay 400 003. Tel: 321125/
337731 (O): (R) 8229233/8128001.
Tlx: 11-73145 ASIM IN.

Vino Synth Chem Pvt. Ltd.,
404 Bezzola Commercial Centre,
Sion Trombay Road, Chembur
Bombay 400 071. Tel: 5522539/
5528958 Cable: VINOBIN. Fax:
5522539.

FOOD FRIERS

Ross Enterprises — See under
"Boilers".

FOOD PROCESSING EQUIPMENT/ PLANTS

Alfa Laval (India) Ltd., Dapodi,
Bombay Pune Rd., Pune 411012.
Tel: 776 321 / 311 960. Fax: 011-
352263.

Atul Consultants (P) Ltd., A-7,
Pushpanjali Enclave, Outer Ring
Road, Pitampura, New Delhi
110034. Tel: 7274590. Tlx: 63085
JNBR Attn: Paliwal, Grams:
ATUCONSULT. Fax: (011)
7274572.

Cantech Machines — See un-
der "Can Closing & Seaming Ma-
chine".

Continental Equipment India
Pvt. Ltd. — See under "Bakery/
Biscuit Equipment".

Fabdecon Engineers — See
under "Agitators".

Geeta Food Engineering, Ashir-
wad Complex, Vashi Village, Opp.
Starling Hospital, Gala No. 2, New
Bombay 400 703. Tel: 022-
7667069.

HMA Consultants Pvt. Ltd.,
859, Sector 15 A, Faridabad 121
002. Tel: 8282040. Fax: 8282040.

Hi-Tech Systems, 80, Hardwar
Road, Dehradun 248 005. Delhi
Office: C-9B, Gangotri Enclave,
Alakhnanda, Kalkaji, New Delhi
110 019. H.O. 25853 D.O.:
6436772. Gr: ATMA

IBP Co. Ltd., A-4 MIDC Area,
Ambad, Nasik 422010 Tel: 29333/
29334 Tlx: 0752259 Fax: 0253-
22362

New Indo International, 135, A,
Bhamburda, Malviya Nagar, New
Delhi 110017. Tel: 6445315/
6453289

Metal Plants — See under

52 BEVERAGE & FOOD WORLD MARCH 1994

"Contra-Rotary Mixers".

'METACOLOR', Shree Preco-
ated Steel Ltd. — See under "Re-
frigeration Equipment & Plant".

FORM-FILL-SEAL MACHINES

Ecc Cec & Co., — See under
"Filling & Sealing Machines".

Gansons Engineers Pvt. Ltd.,
118/121 Swastik Chambers, Off.
Sion-Trombay Rd., Chembur,
Bombay 400 071. Tel: 524548/
524967.

Indec Equipment Pvt. Ltd., —
See under "Aseptic Packaging".

Indian Packaging Machineries,
1-15, D. L. F. Industrial Area, Phase
1, Faridabad 121 003. Tel: 8-
276112. Fax: 0118-212596.

Padmatex Engineering Ltd., 8th
Fl., Mafatlal Centre, Nariman Point,
Bombay 400 021. Tel: 2025452/
243566 Tlx: 011-82730 PEL/011-
86796 PEL IN.

Pakona Engineers (India) Ltd.,
— See under "Machinery, Packag-
ing".

R.M.C. Packaging Systems (P)
Ltd., 25 A & B, Electronic Com-
plex, Kushalguda, Hyderabad
500762. Tel: 622556/853913/
824308. Tlx: 0425-7099 PCO-IN
Grams: VIJAIPAC.

Unique Flexo-Packaging, Gala
No. B-270, Off Manpada Road,
Opp. Kasturi Plaza, Joshiwada,
Dombivli (E) 421 201. Tel:
5785723.

FREEZE DRYING PLANTS

IBP Co. Ltd., Business Group
(Engg.) A-4 MIDC Ambad, Nasik
422010. Tlx.: 0752-259 Fax: 0253-
22362.

FREEZERS

Dairy Den (India) Pvt. Ltd., —
See under "Ice-cream Equipment".

FUMARIC ACID

Amit Fine Chem. — See under
"Agar Agar (Powder / Strips)".

Ganesh Dchydride Ltd. — See un-
der "Additives, Food & Beverage"

GAS ANALYSERS FOR NITROGEN CYLINDERS

Technovation — See under
"Analysers".

GAS MONITORING EQUIPMENT

Technovation — See under
"Analysers"

GELATINE

Amit Fine Chem. — See under
"Agar Agar (Powder / Strips)".

GHEE FILTRATION UNITS

Codex Enterprises -- See under
"Batch Coder".

GLASS & GLASSWARES

Haldyn Glass Limited, Off
Western Express Highway,
Goregaon (East), Bombay 400 063.
Tel: 3730311/4 lines Fax: (022)
8735231) Tlx: 011-70047 HGWL
IN

R. G. Glass Agency — See un-
der "Bottles & Jars, Glass".

GLASS FABRICS, PTFE COATED

Unnati Corporation -- See under
"Adhesive Tapes, PTFE, Glass".

GLYCON

Balaji Dye Chem — See under
"Acids".

GRAINS & CEREALS CLEANING / GRADING MACHINERY

Forsberg Agritech (India) Pvt.
Ltd. 315, Race Course Towers, Race
Course Circle, Baroda - 390 015
Tel: 320597 Fax: 322150.

GRAVITY SEPARATOR

Goldin (India) Equipment Pvt.
Ltd. -- See under "Destoner,
Vacuum Type"

GRINDER, WET & DRY

Sesa Pulverisers, Kala Kila
Road, Dharavi, Bombay 400 017.
Tel: 4121434.

GRINDING MILLS

Frigmaires Engineers — See
under "Agitators".

Kaps Engineers, 831, GIDC
Indl. Estate, Makarpura, Vadodara
390 010. (Gujarat). Tel: 43178.
Grams: KAPS. Tlx: 0175-533 MI-
CON IN. Fax: 0265-43679.

Sesa Pulverisers — See under
"Grinder, Wet & Dry".

GUAR GUM

Acc International, 13/21, Laura
Bldg., 1st Floor, 1st Dhobi Talao
Lane, Bombay - 400 002. Tel: (O)
2058169/3872409 Fax: 2089282
Tlx: 011-86654 PCOK IN.

Alok Chem Corporation, 406,
Goradia House, P.O. Box No.
13048, 100/104, Kazi Syed Street,
Bombay 400 003. Tel: 3425365/
3426390. Grams: GUMSAGAR.

Fax: 91-22-3426390.

Altrafine Gums, 91/17, GIDC Estate, 1st Phase, Vatwa, Ahmedabad 382445. Tel: (0272) 830469. Tlx: 1216611. Fax: (272) 833148.

Amba Gums & Feeds Products, 88/3, GIDC Estate, Vatwa, Ahmedabad 382445. Tel: (0272) 830624. Tlx: 1216611. Fax: (0272) 833148.

Indian Gum Industries Ltd., 51-A, Maker Chambers IV, Nariman Point, Bombay 400 021. Tel: 91-22-2852075-76. Fax: 91-22-2040393. Tlx: 011-8213911 GUM. Gram: INORGANA, Bombay

Kapadia Gumchem Industries, 3, Mint Road, 2nd Floor, Room No. 30, Opp. G.P.O. Box No. 1160, Bombay 400 001 Tel: 2615073/2617217 Gram: PHARMAGUM. Fax: 91-22-2619423 Tlx: 011-86630 KGI IN

GUAR GUM POWDER

Ace International — See under "Guar Gum".

Kapadia Gumchem Industries, — See under "Guar Gum".

Ultrafine Gums, 91/17, GIDC Estate, 1st Phase, Vatwa, Ahmedabad 382445. Tel.: 830469/830353.

GUM ACCACIA

Ace International — See under "Guar Gum".

Alok Chem Corpn. — See under "Guar Gum".

Indian Gum Industries Ltd. — See under "Guar Gum".

Kapadia Gumchem Industries, — See under "Guar Gum".

GUM ARABIC

Ace International — See under "Guar Gum".

Alok Chem Corp. — See under "Guar Gum".

Balaji Dye Chem — See under "Acids".

Indian Gum Industries Ltd. — See under "Guar Gum".

Kapadia Gumchem Industries, — See under "Guar Gum".

GUM KARAYA

Alok Chem Corporation — See under "Guar Gum".

GUMS, FOOD

Alok Chem Corp. — See under "Guar Gum".

Burzin and Leons Agenturen Pvt. Ltd. — See under "Additives,

Food & Beverage"

Indian Gum Industries Ltd. — See under "Guar Gum".

Kapadia Gumchem Industries — See under "Guar Gum".

Olin Chemicals — See under "Acetic Acid"

Uttam Corporation — See under "Cellulose Products"

GUM TRAGACANTH

Ace International — See under "Guar Gum".

Alok Chem Corporation — See under "Guar Gum".

HM FILM MACHINES

V. K. Engineering Corp. — See under "Box Strapping Machinery"

HM - HDPE CONTAINERS

Ratnajeet Polycon Ltd., — See under "Barrels".

HEADSPACE GAS ANALYSERS

Technovation — See under "Analysers".

HEATING ELEMENTS

Koyna Industries, Subhash Est., Oshiwara Bridge, Jogeshwari (W), Bombay 102. Tel: 8283240.

Subash Gupta & Co., 100 Arya Nagar, Ghaziabad 201009. Tel: 871471/8723893/2293795 (Delhi)

HEAT EXCHANGERS

Arctic India Sales — See under "Dehumidifiers".

Precision Tanks & Vessels (P) Ltd., 3-4, Block B, LSC Naraina Ind. Area, Phase II, New Delhi 110 028 Tel: 5705476 / 5708201.

HEATING MANTLES

Lab Instruments, Ratnadecp, 1st Floor, 78, B. Jagannath Shankar Seth Rd., Behind Panchratna, Near Roxy, Opera House, Bombay 400 004. Tel: 3610973. Fax: 3634619.

Manikant Bros. — See under "Anti-Corrosion Chemicals".

Subhash Gupta & Co. — See under "Heating Elements"

HIGH PRESSURE SYSTEMS

Pushkaraj Enterprises — See under "Fluid Extraction Plants".

HOMOGENIZERS

Cosywo Engineering Co. — See under "Agitators"

Frigmaires Engineers — See under "Agitators".

Goma Engineering Pvt. Ltd. B/9, Kayteeco Industrial Estate, Majiwada, Thane 400 601. Tel: 5340875/5346436/5341937. Tlx: 011-72389 TCWE IN Fax: 91-22-5342682

J. T. Jagtiani — See under "Machinery, Food & Beverage Processing".

Mamko Process Equipment Manufacturers — See under "Emulsifiers".

United Technologie — See under "Conveyors".

HUMIDIFIERS

Arctic India Sales — See under "Dehumidifiers".

HYFLO SUPER CELL

Balaji Dye Chem — See under "Acids".

ICECREAM EQUIPMENT

Capital Equipment Co., C-174, Naraina Ind. Area, Phase 1, New Delhi.

Dairy Den (India) Pvt. Ltd., 25, Madhuvan, Ellisbridge, Ahmedabad 380 006. (Representing: Carpigiani S.r.l. (Italy) Tel: 461205/402046 Tlx: 121-7157 DDPL IN. Fax: 91-272-443537.

R & D Engineers — See under "Ice Cream Cone Machines".

Spectrum Machinery Mfrs. Pvt. Ltd., 1510 Maker Chamber V, Nariman Point, Bombay 400021. Tel: 230344 / 223549/2047340 Fax: 0091-22-2047340

ICE CREAM CONE MACHINERY

R & D Engineers, A-41/1, I.D.A. Kukatpally, Phase II, Road No. 4, Hyderabad 500 037 Tel: 040-279121. Fax: (842) 841697

ICE CREAM FILLERS

The Panchal Workshop, P.B. No. 62, Anand Sojitra Rd., Anand 388001. Tel: (012692) 23332 Gr: VARSHA.

ICECUBERS / FLAKERS

Spectrum Machinery Mfrs. Pvt. Ltd. — See under "Ice Cream Equipment"

INDUSTRIAL GAS MONITORS

Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi H.P.O. Bombay 400 025. Tel: 4224461/4303047

INDUSTRIAL HEATERS

Subash Gupta & Co., 100, Arya

Nagar, Ghaziabad 201009. Tel: 8723893.

INSECT KILLERS (INSECTOCUTORS, ELECTRIC)

Gajjar Sales & Service Centre, 11, New BMC Shopping Centre, Senapati Bapat Marg, Bombay 400 025. Tel: 4227017. Res: 4371379.

Opel Industries — See under "Fly Killers, Electric".

INSTRUMENTS, INDUSTRIAL AND PROCESS CONTROL

Lab-Instruments — See under "Heating Mantles".

JERRY CANS

Ratnajeet Polycon Ltd., — See under "Barrels".

JUICE DISPENSERS

Varun Ref-Air — See under "Dispensers, Beverages".

JUICE EXTRACTOR

Geeta Food Engineering — See under "Food Processing Equipment /Plants".

KETTLES (STEAM JACKETED)

Continental Equipment India Pvt. Ltd. — See under "Bakery/ Biscuit Equipment".

KHOA MAKING MACHINES

Varsha Machinery Corporation, C-6, Shivaji Stadium, Mangalwar Peth, Kolhapur 416012. Tel: 20674 Gram: VARSHA CORP.

KITCHEN EQUIPMENT

Advance Equipments Co. — See under "Air Conditioning & Refrig. Plant/Equip."

Continental Equipment India Pvt. Ltd. — See under "Bakery/ Biscuit Making Equipment"

Dairy Den (India) Pvt. Ltd., (Representing Zanussi Grandi Impianti (Italy) — See under "Ice cream Equipment".

Frigmaires Engineers — See under "Agitators".

KNEADERS

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

LABEL GUMMING MACHINE

Jacsons Sales India, 8-4, Morar

Flats, Maninagar (East), Ahmedabad 380 008. Tel: 830156/833408/367388 Grams: JALDEEP.

LABELLING MACHINES

Great Eastern Impex Pvt. Ltd., 1010, Pragati Towers, 10th Flr., 26, Rajendra Place, New Delhi 110 008. Tel: 5711751 / 5737287.

Interlabels, 15, Ravi Indl. Estate, Off Mahakali Caves Rd., Andheri (E), Bombay 400 093. Tel: 8346442.

Jacsons Sales India — See under "Label Gumming Machine".

J. T. Jagtiani — See under "Machinery, Food & Beverage Processing".

Maharshi Udyog, 4, Ruchi, 36, Swastik Society, Navrangpura, Ahmedabad 380009. Tel: 409183 Tlx: 0121-6369 GOPI IN. Fax: 0272 - 425456

Lab Instruments — See under "Heating Mantles".

LABEL PRINTING MACHINE

Codex Enterprises — See under "Batch Coder".

Jacsons Engineers, Phase 4, Plot No. 4701, G.I.D.C. Ind. Estate, Vatva, Ahmedabad 382 445. Tel: 830155 Gram: JALDEEP

LABORATORY EQUIPMENT

Lab Instruments — See under "Heating Mantles".

United Technologie — See under "Conveyor".

LACTIC ACID

Balaji Dye Chem — See under "Acids".

Parul Enterprises — See under "Agar-Agar (Powder/Strips)"

LAMINATED POUCHES

Shreeji Polylaminates Pvt. Ltd., 7 Ajanta Estate, B/h Gujarat Bottling, Rakhial, Ahmedabad 380023. Tel: 369121

LIQUID FILLING MACHINE

Dynatech Marketing Company, 303/F2, Poonam Kunj, Poonam Nagar, Andheri (E), Bombay 400 093. Tel: 8377749 Fax: 836 4254

MSG (AJINOMOTO)

Parul Enterprise — See under "Agar-Agar (Powder/Strips)"

MACHINERY, CONFECTIONERY

Continental Equipment India Pvt. Ltd. — See under "Bakery/Biscuit Equipment"

Eskeyar Engg. Co. (P) Ltd., 10/5 Developed Plot, Ambattur Indl. Estate, Madras 600 058. Tel: 654137 / 652369. Fax: 499 1447.

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Mangal Engineering Works — See under "Biscuit Making Machines".

United Technologie — See under "Conveyor".

MACHINERY, DAIRY PROCESSING

Fabdecon Engineers — See under "Agitators".

Filtron Engineers P. Ltd., SPARC, 117-A, Vithalwadi Road, Pune 411 030. Tel: 0212/440068

Frigmaires Engineers — See under "Agitators".

United Technologie — See under "Conveyor".

MACHINERY, FOOD & BEVERAGE PROCESSING

Advance Equipment Company — See under "Airconditioning/Refrigeration Plant & Equipment".

Fabdecon Engineers — See under "Agitators".

Fillopack Industries — See under "Bottle Fillers".

J.T. Jagtiani, National House, Tulloch Road, Apollo Bunder, Bombay 400 039. Tel: 2020028/2021433.

Perfect Magnets (P) Ltd — See under "Magnetic Separators"

Ross Enterprises — See under "Boilers".

Saffaire India — See under "Air Conditioning/Refrigeration Plants & Equipment".

Shriyan Enterprises, 33, Sunil Shopping Centre, J. P. Road, Andheri (W), Bombay 400 058. Tel: 826318/820062.

Sifter India Food Processing Machines Pvt. Ltd., Plot No. 227, Sector 24, Faridabad 121 005, Haryana. Tel: 8242586 / 8242597. Grams: SIFTER.

United Technologie — See under "Conveyor".

Westfalia Separator India Pvt.

Ltd., 201, Kirti Deep, 2 Nangal Raya Business Centre, New Delhi 110 046. Tel: 011-5500538/5500562 Fax: 011-5598013 Tlx: 76299 WSIN.

MACHINERY, PACKAGING

A. R. Packaging Systems Ltd., Suryodaya, 1-10-60/3, Begumpet, Hyderabad 500 016. Tel: 825530.

Aarkey Industries, 1, Hormuzd, 131, August Kranti Marg, Bombay 400 036. Tel: 367-0537, 367-5277 Gram: CRAFTWORLD.

Bhagwati Supervac Pvt. Ltd. "Bhumika" Sheth C. G. Rd., Next to Associated Petrol Pump, Ellisbridge, Ahmedabad 380 006 Tel: (0272) 445682 Tlx: 0121-6630 BHAVIN.

Crystal Engineering Co. India — See under "Filling & Sealing Machine"

Frigmaires Engineers — See under "Agitators".

Ganga Singh Sukhwinder Singh & Sons — See under "Canning Machinery & Plants".

H. R. Paper Machinery Pvt. Ltd. — See under "Pouch Filling Machine".

Indec Equipment Pvt. Ltd. — See under "Aseptic Packaging"

Jacsons Sales India — See under "Label Gumming Machines".

Kaps Engineers — See under "Grinding Mills".

Monga Packaging Pvt. Ltd., Box No. 17622, Mamlatdar Wadi Road, Malad (W), Bombay 400 064. Tel: 8821334/8821662.

Novel Termoplast Pvt. Ltd., 316 Tulsiani Chambers, Nariman Point, Bombay 400 021.

Package India, W-115 A, III Avenue Anna Nagar, Madras 600040.

Pakona Engineers (India) Pvt. Ltd., 22-D, Wadia Charities Bldg., 2nd Floor, S.A. Brelvi Street, Fort, Bombay 400 023. Tel: 2872181/2874642.

Production Engg. Consultants — See under "Pillow Pack Machines".

R. G. K. Enterprises, Madhu Kunj, Vinod Baug, Juhu-Line, Block No. 12, Ground Floor, Andheri (W), Bombay 400 058.

Recon Machine Tools Pvt. Ltd. — See under "Can Closing & Seaming Machines".

Rollatainers Limited, 13/6, Matunga Road, Faridabad,

Haryana. Tel: 8275342/72/19. Tlx: 031-63209. Grams: ROLAPAK, FARIDABAD. Fax: 8275392/6424550.

Samarpan Fabricators Limited — See under "Filling & Sealing Machines".

Subash Gupta & Co. — See under "Heating Elements"

Ultra Enterprises, CB-229, Ring Road, Naraina, New Delhi 110028. Tel: 5435556 / 5437795 / 5442289 / 5457508.

Unique Flexo Packaging — See under "Automatic Form-Fill-Seal Machines".

MACHINERY, PHARMACEUTICAL/CHEMICAL

Advance Equipment Co. — See under "Air Conditioning/Refrigeration Plant & Equip."

Fabdecon Engineers — See under "Agitators".

Fillopack Industries — See under "Bottle Fillers".

J. T. Jagtiani — See under "Machinery, Food & Beverage Processing".

MACHINERY, WRAPPING

R. G. K. Enterprises — See under "Machinery, Packaging".

MAGNETIC SEPARATORS

Perfect Magnets Pvt. Ltd., 345, A. R. Street, Near Crawford Market, Bombay 400 003. Tel: 3420065/3426196-97 Fax: 91-22-208 3184. Tlx: 011-86942 CLNC IN ATT. PERFECT.

MALT EXTRACT

Amit Fine Chem — See under "Agar Agar (Powder/Strips)"

Balaji Dye Chem — See under "Acids".

MARINE BOILERS

Jaya & Company — See under "Boilers".

MATERIAL HANDLING SYSTEMS

Advance Dynamics, Plant 1, B-110, Mayapuri Industrial Area, Phase 1, New Delhi 110 064.

Ferro Foundries Private Ltd. — See under "Conveyor, Roller".

Frigmaires Engineers — See under "Agitators".

Goldin (India) Equipment Pvt. Ltd. — See under "Destoner, Vacuum Type".

Indo-Berg Limited, 509 Mansarovar 90, Nehru Place, New Delhi 110019. Tel : 6431908/6438365 Tlx : 031-62332/031-70241 Fax: 11-6464994

Mac Industrial Systems, C/80, Snehdhara Society, Dadabhai X Road No. 3, Vile Parle (W), Bombay 400 056. Tel : 8324244.

Maharshi Udyog — See under "Labelling Machines".

United Technologie — See under "Conveyor".

MEAT FLAVOUR

Tajir Private Ltd. — See under "Caramel Food Colour".

METERING PUMPS

Jagdish Engg. Works — See under "Pumps".

MIXERS, INDUSTRIAL

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Lara Engineers — See under "Agitators".

Metal Plants — See under "Contra-Rotary Mixers".

Remi Engineering Industries Ltd., 11, Cama Industrial Estate, Walbhat Lane, Goregaon (E), Bombay 400063 Tel: 8731998/8732729 Tlx: 011-70118 Fax: 234216.

United Technologie — See under "Conveyor".

MIXERS, POWDER & PASTE

Cosywo Engineering Co. See under "Agitators".

Fabdecon Engineers — See under "Agitators".

Frigmaires Engineers — See under "Agitators".

Metal Plants — See under "Contra-Rotary Mixers".

United Technologie — See under "Conveyor".

MOISTURE ANALYSER BALANCES

Anamed Instruments Pvt. Ltd., 1st Fl., Sita Estate 'A', Plot CTS-133/135 Mahul Rd., Chembur, Bombay 400 074.

MOLASSES MIXER

Trumatic Engineers, 81/18, GIDC Estate, Vatwa, Nr. Bank of India, 1st Phase, Ahmedabad 382 445. Tel: 00-91-272-830-353. Fax:

00-91-272-833-148

OIL FIRED BOILER

Cinni Engineering Pvt. Ltd. — See under "Boilers".

Kalpna Boilers & Chemical Plants Mfg. Co. — See under "Boilers".

OIL SEEDS CLEANING AND GRADING MACHINERY

Forsberg Agitech (India) Pvt. Ltd. — See under "Grains & Cereals Cleaning/Grading Machinery".

OLEORESINS

Bhagat Impex Pvt. Ltd., 164, Sitaram Poddar Marg, Bombay 400 002. Tel: 316928/29/95 Tlx: 011-85356.

ORANGE / JUICE EXTRACTOR

Mysore Precision Engineers, C-123/124 Industrial Area, Yadavagiri, Mysore 570 020. Tel: 24885. Grams : PRECISION

ORANGE OIL

Balaji Dye Chem — See under "Acids".

OVENS, BISCUIT & BAKING

Admir Engineers -- See under "Bakery/Biscuit Equipment."

Aifso Enterprises, A/1, Veena Beena Apts., Sewri (W), Bombay 400015 Tel: Off: 4137339/4130926 Res: 4137109/4134568 Fax: 91-22-4137339.

Continental Equipment (India) Pvt. Ltd., — See under "Bakery / Biscuit Equipment".

Grovers Pvt. Ltd., 226/232, Kailandas Udyog Bhavan, Near Century Bazar, Bombay 400 025. Tel: 4220002/4303223. Tlx : 71672 Cable : GROFROST

OVENS/ TRAY DRYERS (See also "Dryers, Ovens/ Tray, etc.,")

Ami Industries, 8, Surve Indl. Estate, 1st Sonawala Cross Rd., Goregaon (E), Bombay 400 063. Tel: 8734753/8727120.

Continental Equipment India Pvt. Ltd. — See under "Bakery/ Biscuit Equipment"

Eec Cee & Company — See under "Filling & Sealing Machines".

Flora Engineering Co. — See under "Fluid Bed Dryers".

Kailash Scientific Co., 28, Universal Ind'l Estate, I. B. Patel Road, Goregaon (E), Bombay 400 063. Tel: 8734735/8731836.

Manikant Bros. — See under "Anti-Corrosion Chemicals".

Sakav Enterprises — See under "Air Driers".

Thermal Instruments & Equipments, 2-1-478 Nallakunta University Road, Hyderabad 500044. Tel: 41720.

OXYGEN METERS

Technovation — See under "Analysers".

PACKAGING FILM

Plastic International — See under "Packaging Material".

PACKING MACHINERY

Ebrahimjee Essabhai & Sons, 11 Old Hanuman Lane, Princess St., Bombay 400002. Tel: 2011694.

Pretty Packwell Pvt. Ltd., 173 Parekh Nagar, S. V. Rd., Kandivali (W), Bombay 400 067. Tel : 8050934 / 8055904.

Rishabh Automation, Rishabh, 28/10 Kothrud, Near Tejas Soci-

ety, Pune 411029. Tel : 369693. Fax : (91) 212-662210.

Selall, 'Geetanjali' 9 Deccan College Road, Pune 411006. Tel : 668369.

PACKAGING MATERIAL

Ankit Packaging Pvt. Ltd. — See under "Film Wrappers"

Boxboard Industries, J/17, MIDC Bhosari, Pune 411 026. Tel : (0212) 790313 / 792286.

Central India Packaging Co. (P) Ltd. and Allied Companies, 3-6-140, Liberty Road, Himayath Nagar, Hyderabad 500029. Tel : 236645/230045, 233345, Tlx: 425-2257, Fax : 0842-233345.

Compack Systems, E-211, Flat-ted Factory Complex, Okhla Indl. Area, Phase III, New Delhi 110020. Tel : 634065 / 6831545.

Fine Plast Industries Pvt. Ltd., Sarang Street, Taher Bldg, 1st Flr., Bombay 400 003. Tel: 329303/345075. Grams: POLUDRUMS. Telex: 011-83818 NPAI IN.

Gansons Engineers Pvt. Ltd., 118-121, Swastik Chambers, Off Sion-Trombay Road, Chembur, Bombay 400 071. Tel: 524548/

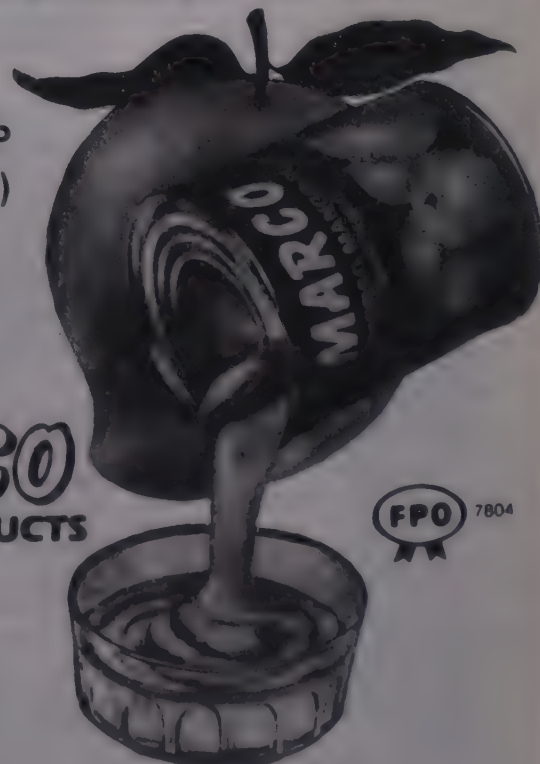
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RATNAGIRI 415 803
Tel.: 224

524967. Tlx: 011-72388. Grams: INMAGANSON.

Indec Equipment Pvt. Ltd. — See under "Machinery, Packaging"

Indu Packagings Pvt. Ltd., Mecnakshi, S. V. Road, Vile Parle (W), Bombay 400 056. Tel: 6367645/6367762.

Jayna Packaging Pvt. Ltd., Jayant House, Bail Bazar, Kurla-Andheri Rd., Bombay 400 070. Tel: 5144038.

Maxxon India Limited, 12th Flr., Devika Tower, 6, Nehru Place, New Delhi-110019. Tel: 6445513. Tlx: 03162505 MAX IN. Grams: MAXAPA.

Milan Industries, 20(4) Suryodaya Mill Compound, Opp. Jagdish Textile Mills, Tardeo, Bombay 400 034. Tel: 4942044/4948777.

Moss Plastics & Films Pvt. Ltd., W-42(H), MIDC, Ambad, Nashik 422 010. Tel: 2841/2842.

Package India, No. 4A (K.G.) Street, Mathiazhakan Nagar, Padi, Madras 600050. Tel: 6257260.

Plastic International, B/13, Nanddham Indl. Estate, Marol, Andheri (E), Bombay 400 059. Tel: 8320798/8322683 Tlx: 11-79498 Gr: Interplast Fax: (011) 8366237.

Propack Industries — See under "Films, Multilayer".

Tender Care International, P. O. Box 8044, Bombay 400 056.

PACKAGING TAPES

Polypak Products -- See under "Adhesives/Adhesive Tapes".

PALLET HANDLING SYSTEM

Mac Industrial Systems — See under "Material Handling System".

PAPAIN

(Anti Turbidity Agent)

Enzo-Chem Laboratories Pvt. Ltd., 'Kailas', 3rd Floor, 320, Sir Bhalchandra Road, Matunga (E), Bombay 400 019.

Karnataka Dehydrates Ltd., 42 Indl. Suburb, II Stage, Goruguntapalya, Opp FTI, Bangalore 560022

PARAFFIN WAX

Balaji Dye Chem — See under "Acids".

PARBOILING PLANTS

Agro Engineering Products. (Delhi) P. Ltd. 38, South Extn. Part

I, New Delhi 110049. Tel: 698928, 617928.

PASTEURIZERS

MF Marketing Pvt. Ltd., B-15, Arjun Centre, B. S. Devshi Marg, Govandi, Bombay 400088. Tel: 5557515/5560947 Tlx: MF IN 76502 Fax: 91-22-0569

PASTE & LIQUID FILLING MACHINE

United Technologie — See under "Conveyor".

PECTIN

Amit Fine Chem. -- See under "Agar-Agar (Powder/Strips)"

Balaji Dye Chem — See under "Acids".

B. I. Mehta — See under "Acids".

Kapadia Gumchem Industries - See under "Guar Gum"

Manak Citrus Products Pvt. Ltd. — See under "Essential Oils".

Parul Enterprises — See under "Agar Agar (Powder/Strips)"

Sesu Trading Corporation — See under "Acids".

Vidarbha Fruit Products Pvt. Ltd. — See under "Additives".

PICKLE CUTTING & SLICING MACHINE

Liston Laghu Udyog, Hirabhai Compound, Plot No. 11, Gala No. 3, Ghorapdeo, 1st Cross Lane, Reay Road, Bombay 400 010. Tel: Off: 588579. Fact.: 8723021/8513224.

PILFER PROOF CAP MAKING MACHINES

Advance Packaging — See under "Bottle Closure Machinery".

PILLOWPACK PACKING MACHINES

New Indo International — See under "Food Processing Equipment/Plants".

Production Engineering Consultants, 206, Aakaar Kalyan Complex, Yari Rd., Versova, Bombay 400 061. Tel: 6290161, 6271021.

PILLOWPACK POUCHES

Trend Pack, 4, Arvind Comm. Bldg., 1st Floor, Sun Mill Compound, Lower Parel, Bombay 400013. Tel: 494 6680/81; Fax: 91-22-493380

PLANETARY MIXER

Fabdecon Engineers — See under "Agitators".

Sigma Engineering Industries

Pvt. Ltd., Unit No. 112, Sun Industrial Estate, Sun Mill Compound, Lower Parel, Bombay 400013. Tel: 4927801.

United Technologie — See under "Conveyor".

PLASTIC ROLLS, PRINTED

Shreeji Polylaminates Pvt. Ltd. -- See under "Laminated Pouches"

PLATINUMWARE

Lab Instrument — See under "Heating Mantles".

PNEUMATIC CONVEYING SYSTEMS

Indcon Polymech Ltd. — See under "Air Blowers".

PNEUMATIC CRUSH KNIFE HOLDER

Liston Laghu Udyog — See under "Pickle Cutting & Slicing Machine".

POLYETHYLENE COATED PAPER

Guardian Plasticote Limited, 12, HOCHIMINH Sarani, Calcutta 700071. Tel: 242-7676/242-9914/242-4795, 242-7675. Tlx: 21-7459 GARD IN. Grams: EXTRULAM. Fax: 91-33-242 2088.

POLYETHELENE FILM

Ureka Polymer (P) Ltd., 243/B/1, Najaf Garh, New Delhi 110043. Tel: 89-54337/89-50792/89-26011. Fax: 110-89-55493.

POTASSIUM META BI SULPHITE

Allied Chemical Corp., R1/300, Raopura Rd., P. B. 280, Barda 390 001 Tel: 51843 / 50969

Balaji Dye Chem — See under "Acids".

POUCH MAKING MACHINES

Chinoy Electronics, 112 Akshay Industrial Complex, Of Dhole Patil Road, Pune 411001 Tel: 662698/663885

Eee Cee & Co. — See under "Filling & Sealing Machines".

Indec Equipment Pvt. Ltd. — See under "Aseptic Packaging" Subash Gupta & Co — See under "Heating Elements"

POUCH FILLING MACHINES

H. R. (Paper) Machinery Pvt. Ltd., 116 Acharya Commercial

Centre, Near Basant Cinema, Chembur, Bombay 400 074. Tel: 5519723/5551452 Tlx: 011-71036 SUPR IN

Indec Equipment Pvt. Ltd. — See under "Aseptic Packaging".

Sealers India — See under "Sealing Machines".

Unique Flexo Packaging — See under "Automatic Form-Fill-Seal Machines".

POWDER/PASTE BLENDERS

Mamko Process Equipments Manufacturers — See under "Emulsifiers".

POWDER FILLING MACHINE

Frigmaires Engineers — See under "Agitators"

PP BOX STRAPPING MACHINE

Ultra Enterprises — See under "Machinery, Packaging".

PRESSURE GAUGES

Goma Engineering Pvt. Ltd., B-9, Kayteeco Ind. Estate, Behind Paper Products, Majiwada, Thane 400 601. Tel: 501424/591514.

PRESSURE VESSELS

Energy Machine — See under "Boilers".

Otoklin Plants & Equipments Limited, Plot No. 1, Shah Indl. Area, Veera Desai Rd., Andheri (W), Bombay 400 058. Tel: 8267172/826476.

PROCESS PLANT EQUIPMENT

Gopinath Engineering Company, 4 Ruchi, 36 Swastik Society, Navrangpura, Ahmedabad 380009. Tel: 409183 / 425456. Fax: 0272-42545.

Mamko Process Equipments Manufacturers — See under "Emulsifiers".

P.J. Electronics, 46 Dr. Ambedkar Rd., Sangam, Pune 410001. Tel: 667710.

PULVERISERS

D.P. Pulveriser Works, Modi & Modi Bldg., 76, Nagindas Master Road Extn., Opp. Maharashtra State Co-op. Bank Ltd., Fort, Bombay 400 023. Tel: 276435/274901 Grams: GRANULE

Frigmaires Engineers — See under "Agitators".

Kaps Engineers — See under

"Grinding Mills".

Sesa Pulverisers — See under "Grinder, Wet & Dry".

United Technologie — See under "Conveyor".

PUMPS

Beer, Carbonator, Centrifugal, Rotary, Vacuum etc.

Acmevac Sales Pvt. Ltd. — See under "Bottle Washers & Rinsers".

Elmach Engineering Co., 410, Hill View Co-op. Ind. Estate, Off L.B.S. Marg, Ghatkopar (W), Bombay 400 086. Tel: 270160/272760.

Flocon Equipments, C 11/7 Bonanza Indl. Estate, Ashok Chakravati Rd., Kandivli (E), Bombay 400 101. Tel : 8892017 / 8823055.

Jagdish Engineering Works, 7/ 2, Rocky Industrial Estate, I. B. Patel Road, Goregaon (E), Bombay 400 063. Tel: 8731134.

SSP Pvt. Ltd. — See under "Evaporators"

Technomech Pumps, Bombay Wire Compound, Gala No. 10, I. B. Patel Rd., Goregaon (E), Bombay 400 063.

QUALITY CONTROL INSTRUMENTS

J. M. Parekh, 11 M. G. Rd., Red Cross House, 1st fl., Behind Canara Bank, Pune 411001. Tel : 640663 / 658245. Tlx : 643679 / 643688.

REACTORS

Fabdecon Engineers — See under "Agitators".

REFRIGERATION EQUIPMENT / PLANT

Airtech Engineers, B-93 Ph II, Okhla Indl. Area, New Delhi.

Continental Equipment India Pvt. Ltd. — See under "Bakery / Biscuit Equipment"

Hindustan Refrigeration Industries, 2 & 4, Netaji Subhas Marg, Darya Ganj, New Delhi 110002. Tel : 3271898/3277725/3277735/3271152. Fax : 011-3271152, Grams : CORKMAN.

'Metacolor', Shree Precoated Steel Ltd., Hanuman Bldg., 308 Perin Nariman Street, Behind RBI, Fort, Bombay 400001. Tel : 2662540 / 2661232 / 2661141. Tlx : 011-82793 YOGI IN Gram : AJMERABILD. Fax : 91-22-2661878.

National Refrigeration Works, 2 & 3, Subhash Marg, Darya Ganj,

New Delhi 110002. Tel : 3274041 / 3274042/3271252. Grams : KOOLING Fax : 011 3270740.

Refrigerators & Home Appliances (P) Ltd., 158, Anna Salai, Madras 600 002. Tel: 868 717 / 867286 Gram : URI GOLD

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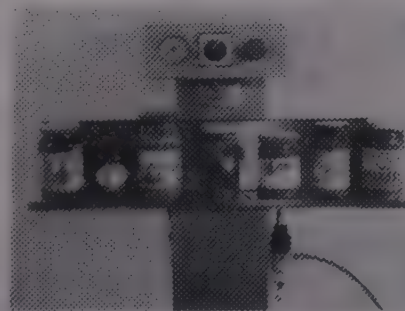
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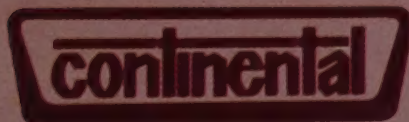
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